MASTER

I

Air Ministry

Meteorological Office

FROST IN SOUTH-WEST ENGLAND

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Frost and its effect upon agriculture has long been a question exercising the minds of growers in many parts of the world. The problem is naturally most acute in temperate latitudes and is especially so in those regions where the winters are sufficiently mild, on average, to promote the early growth and development of many valuable crops.

Severe frosts occurring during this period of growth, when the plant, its blossom or early fruit are not sufficiently developed to withstand low temperatures, can be devastating in their effect.

The British Isles, with its mild maritime climate, is one of those areas in which frost frequently interferes with the production of essential crops. Much work is now being done to combat this menace; improved methods of orchard heating are being sought; the effects of wind breaks and other factors are all being tried out with a view to being able eventually to offer the grower some effective means of saving his crops when they are threatened. Apart from their purely mechanical aspects all these investigations are essentially meteorological.

Before this problem of frost can be effectually attacked however, it is necessary that as complete a background as possible should be filled in, that is to say, the investigator must have available a complete analysis of all the data. Without that background all specialised work remains local, applicable only to the area studied until adjusted and re-shaped to fit the conditions prevailing in other areas. It was in order to contribute to such a background that the work to be discussed was carried out.

The agriculturalists and horticulturalists of south-west England, in common with those of other parts of the British Isles, suffer repeatedly from the ravages of frost. On the suggestion of the National Agricultural Advisory Service, South-West Province Headquarters, Bristol, the ensuing preliminary survey was initiated. The object of the investigation was to gather together all available information concerning temperature at or below 32°F. and to present it in a form easily appreciated and used. Whilst to some extent it is an academic study, the work was primarily undertaken in the interests of all those growers whose crops are yearly threatened by frosts. Thus certain meteorologial standards receive less attention than the more practical ones which are applicable to agriculture. For this reason a critical temperature of 32°F. is considered of less importance than one of 30°F. In horticultural farming practice 32°F. has no special significance since most crops can withstand one or two degrees of frost. It is when the temperature falls below 30°F. that the real damage is done.

The area covered by this investigation is that geographic region commonly known as the "south-west peninsula", which is bounded on the north by the Severn Estuary, on the south by the English Channel, and on the east by a line joining Poole and Bath and on to the River Severn just above Bristol. Climatically this area is a clean-cut unit which can be separated from the adjacent areas to the east by virtue of the great influence which the close proximity of the sea exercises upon its climate. That influence tends to decrease in the extreme east of the region where the climate more closely approximates to that of south-east England and the Midlands than it does to the conditions prevailing in the peninsula proper.

When broadly considered, the physical structure of the area is fairly simple. A narrow coastal lowland belt surrounds the high core of Dartmoor, Exmoor and Bodmin Moor. The greater elevation of the interior is, however, alleviated by the presence of several fertile river valleys, whilst the extensive Vale of Taunton, penetrating from the north coast almost to the English Channel serves to isolate the high ground of the Mendip Hills and Salisbury Plain from the other high regions of the peninsula. Thus it can be seen that the shape of the area

and its topography conspire together to produce the same effect on all the main meteorological elements - a more or less uniform gradient away from the coast. The incidence of frost is no exception to that rule as can be seen at a glance when studying the charts of frost distribution. The interior highlands can also be held responsible for certain anomalies which upset the above simple pattern. Acting as a gathering ground for cold air on calm radiation nights they naturally direct its flow outwards towards the sea. Generally speaking this air finds its way to the coast and out on to the sea without becoming unduly concentrated on any large scale in one particular area. In some places, however, this cold air becomes canalised and makes its way regularly down a river valley or natural funnel in the hills. Such a region of canlised air flow gets more than its fair share of cold air from the interior and consequently has a far worse frost record than another place closely adjacent but which is not in the path of these cold air streams. Such anomalous areas are noted later in the text.

Like all meteorological elements, temperature has a well defined vertical gradient superimposed on its horizontal or geographic gradient. This vertical gradient, being most marked within the first few feet of the ground, is of very great importance to all agriculturalists since it affects the layer of air in which practically all their crops grow. Thus while the tops of trees or shrubs might escape a certain frost, the lower branches and smaller crops nearer the ground could suffer severely. Some indication of this difference of temperature is indicated by the readings of the thermometer at approximately 4 ft. in the screen and the grass minimum thermometer suspended very near the ground. Screen temperature and grass minimum temperature records form the basis of this discussion.

Two distinct periods have been used in compiling the data contained in this paper. In the cases of the dates of first and last frosts, and the frequencies of frost periods, a period of 30 years, 1912-41 was used. For all other analyses, calculations are based upon a 20-year period, 1927-46. This was necessary in order to use all available data and so carry out as complete a survey as possible. Whilst not completely satisfactory, the periods are long enough for the purposes of frequency analysis. Checking against the normal conditions, it was found that the periods were such as to bias the results in the sense that the months of February, March and December were somewhat colder, on balance, than usual, whilst all other months (June - September being ignored) were warmer. These facts should be borne in mind when the data are being used.

Duration of Frost Period

Whilst it is obviously impossible to forecast the absolute length of any coming frosty period, it is possible to set average dates to the beginning and the end of the period by using the accumulated data of many years. By this method it can be ascertained that given average conditions, the possible period of frost in a specified place will cover a certain period of time and will probably commence and end on certain average dates. Fig. I indicates the average dates when frosts may be expected to commence whilst Fig. II shows the average dates of the last frosts. It will be seen that first frosts usually occur early to the east and well inland on the peninsula proper but come progressively later towards the coast and the south-western tip. Thus whilst the extreme south-west of the area has generally to wait until the first half of December before having its first frosts, the eastern region can reasonably expect them two months earlier. Similarly, last frosts follow the same pattern but in reverse, the latest dates, in May, occurring in the east whilst the early average cessation of frost, which may come at the beginning of March, is a feature of the coastlands and the extreme south-west.

By combining the average dates of first and last frosts the normal frost period is obtained (Fig. III) which illustrates again the relative severity of conditions inland and to the east when compared with those of the coastal and south-west areas. For round figures it works out that Wiltshire in the east can expect about 200 days of frost per annum whilst south-west Cornwall has only 90 days on average.

This variation in the length of frost period is obviously of importance in determining the distribution of those plants and crops which require a frost-free period of considerable length. It is realised, however, that not only the length

of the frost period but also its approximate dates are required. The average dates given in Fig. III to some extent cover this, but for a more detailed analysis of the periods of frost occurrence it is necessary to refer to the frequency tables quoted later. Setting an average date to the beginning and the end of a frost period naturally raises the question as to the degree of reliability of those dates. Will most of the dates of first or last frost be clustered closely around the date given or will they be scattered over a wide period? To test this, the mean deviation of the dates of all last frosts at all stations available was calculated. The deviation of a single record is its difference from the average of a number of records of the same element and may be positive or negative. The mean deviation or average variability as it is sometimes termed, is the sum of all the deviations without regard to sign, divided by their number. In other words the mean deviation represents the average scatter of all the records around the mean. In the case of dates of last frost, the figure for the mean deviation is the period, grouped around the average date of last frost, during which the last frost, in any given year, is most likely to occur. Thus in Table I, it is seen that the average date of the last frost at Penzance is March 2 and that the mean deviation is 21·0. Whilst March 2 is the average date of all last frosts in the period used, no one expects any but an occasional last frost to occur exactly on that date. The mean deviation of 21·0 does however give the period, in days, arranged around March 2, when most last frosts at Penzance can be expected to occur. From this calculation of the mean deviations a curious fact emerged. When all the stations are arranged in order of the magnitude of their mean deviations they are also arranged chronologically according to the average dates of the last frost.

TABLE I

Mean Deviation of the Average Date of the Last Frost

	Mean Deviation	Average date of Last Frost
Ilfracombe	25.6	February 25th
Penzance	21.0	March 2nd
Gulval	21.0	March 22nd
Portland Bill	20.4	February 28th
Torquay	20.0	March 19th
Redruth	19.3	March 27th
Plymouth	18.9	March 26th
Salcombe	17.9	March 24th
Teignmouth	17.3	March 22nd
Woolacombe	17.0	March 6th
Weymouth	17.0	March 29th
Fowey	16.5	March 24th
Mount Batten	15.9	March 22nd
Sidmouth	15.1	April 6th
Paignton	14.7	April 3rd
Newquay	14.7	March 31st
Bude	14.6	April 18th
Princetown	14.3	April 17th
Seale Hayne	14.0	April 13th
Tavistock	14.0	April 19th
Exmouth	13.8	March 30th
Falmouth	13.6	March 12th
Long Ashton	13.6	April 26th
Killerton	12.9	April 27th
Holton Heath	12.8	May 1st
Bath	12.3	April 25th
Barnstaple	11.9	April 22nd
Shaftesbury	11.4	April 21st
Cullompton	9.8	April 28th

Table I indicates that when the average date of the last frost is early in the year, then the average scatter of all last frosts around that date is some

20 to 25 days. On the other hand, the later the last frosts the less the scatter. In other words the later the average date of last frost the more nearly is it likely to be approached every year, i.e. the more reliable is that date.

The distribution of the mean deviation (Fig. IV), whilst conforming in the main to the usual pattern, brings out some interesting facts. The most obvious is that the average date of the last frost, as indicated in Fig. II, is, on average, accurate to within a fortnight over most of the area. It is only when the coastal fringe is reached that the scatter exceeds that limit. Certain departures from that condition are seen, notably

(1) Falmouth area
(2) Barnstaple area
(3) Totnes area
(4) Just east of Exmouth

On the assumption that the lower the mean deviation the more persistently regular is the frost period, it would appear that these areas are more subject to frost than those immediately adjacent to them, and are collecting grounds for all the cold air which forms around them. They can be regarded as large-scale frost pockets. Opposed to such regions are those where the mean deviation is large. Such an area is that of the north Devon coast where the average scatter of the last date is as high as 26 days around the mean. It is reasonable to assume that the occurrence of frosts in such an area is completely fortuitous, and that whilst in a bad year the last frost may come late it might, with ordinary luck, have come proportionally early in the year. Reference to the frequency tables for Ilfracombe will indicate the degree of probability governing the monthly distribution of frosts in such an area.

Table II

Mean Deviation of the Average Date of the First Frost

	Mean Deviation	Average date of First Frost
Gulval	26.7	December 4th
Ilfracombe	24.7	December 18th
Portland Bill	23.1	December 18th
Penzance	21.2	December 13th
Falmouth	21.1	December 10th
Redruth	19.2	November 30th
Salcombe	17.8	November 30th
Fowey	17.6	November 24th
Woolacombe	17.3	December 4th
Newquay	16.2	November 26th
Torquay	15.9	November 28th
Mount Batten	15.5	November 22nd
Bude	14.9	November 12th
Shaftesbury	14.9	November 4th
Seale Hayne	14.7	November 11th
Princetown	14.6	November 5th
Plymouth	13.9	November 21st
Teignmouth	13.0	November 23rd
Weymouth	12.9	November 16th
Exmouth	12.9	November 9th
Bath	12.8	October 22nd
Tavistock	12.2	October 29th
Paignton	11.9	November 9th
Cullompton	11.6	October 19th
Killerton	11.5	October 23rd
Sidmouth	9.8	November 9th
Long Ashton	9.7	October 25th
Holton Heath	9.6	October 20th
Barnstaple	7.1	October 25th

The mean deviation of the average date of the first frost at the same stations has also been calculated (Table II) with much the same result as when the last frosts were dealt with in the same manner. The arrangement according to the magnitude of the mean deviation again placed the average dates of first frosts in chronological order with the largest deviations corresponding to the latest dates of the first frosts. Moreover the two lists, with some small re-adjustments are almost identical, the stations like Gulval, Ilfracombe and Penzance which are well exposed to sea influence, appearing at the top of both lists while those inland stations such as Holton Heath, Cullompton and Long Ashton again show the smallest mean deviations. Ignoring small departures from the general arrangement, it is noted that certain stations occupy very different positions on the two lists. Thus Plymouth, Teignmouth, Weymouth, Sidmouth and Paignton all show much smaller mean deviations for the average date of the first frost than for the last. This would suggest that with the more precise definition given to the average date of the first frost, these stations experience more consistent frosts at the beginning of the frost period than they do at the end. They can be regarded as areas where a greater concentration of frosts is experienced at the beginning of the period than at the end. Falmouth and Shaftesbury on the other hand show reverse characteristics in that the mean deviation of the average first frost is much greater than that of the last frost, indicating that the end of the frost period is more liable to frost about the average date given than is the period at the beginning of the frost period. It should be noted that the number of frosts is here being discussed and that the intensity of the frosts has so far been ignored.

The average dates of the first and last frosts are useful guides to the frost tendency of a given area, but care must be taken to avoid placing too much reliance upon what are, in reality, only generalizations. It is safe to assume however that these average dates become more reliable, the earlier and later they are. Thus Ilfracombe with its short average frost period of 70 days but high mean deviations of 24.7 and 25.6 can expect considerable fluctuations in the dates of its first and last frosts and therefore in the possible lengths of its frost periods. In point of fact the degree of this fluctuation is as high as from 0 to 171 days. Holton Heath on the other hand with a longer average period of 194 days and low mean deviations of 9.6 and 12.8 is more consistent in its possible range with 141 to 245 days of frost.

As a further illustration of the significance of the mean deviations, sample groups of the stations have been selected and histograms, of each group taken as a whole, constructed.

The groups used are

Fig. V	Penzance, Gulval, Portland Bill, Torquay	Average mean deviation of date of last frost = 20.6
Fig. VI	Paignton, Newquay, Bude, Princetown	Average mean deviation = 14.6
Fig. VII	Holton Heath, Bath, Barnstaple, Shaftesbury	Average mean deviation = 12.1

It is clear from the above figures that the lower the mean deviation the less the scatter. Thus Fig. V, representing a group with a high mean deviation, has a wide and irregular scatter of departures around the mean which is the 0 line indicated. In Fig. VI the average mean deviation is lower, 14.6, and this has led to a contraction of the scatter, whilst in Fig. VII with an average mean deviation of 12.1 the histogram is compact and arranged far more closely around the mean, than in either of the other cases. It will be noted that in Fig. VII the - 2 to + 2 departure group occurs far more frequently than any of the greater departures from the mean, and that there is a reasonably symmetrical and rapid decrease of frequency with increasing departure away from the mean.

These three histograms illustrate the point made earlier, that the lower the mean deviations the more reliable, in practice, are the average dates of the first and last frosts.

Frequency of frost periods

Having considered the average dates of first and last frost, the average scatter of those dates and the average length of the frost period, it is now necessary to analyse the dates used for these averages and so gain a clearer picture of what they really represent.

The yearly totals of days between the first and last frosts were calculated and arranged into groups according to an arbitrary scale, in intervals of 20 days. These totals in each group were then converted into percentages of the number of years of observation used and so the percentage frequency of frost periods was obtained.

Table III

Percentage Frequency of Frost Periods
1912-41

Days	Bath	Cannington	Long Ashton	Holton Heath	Barnstaple	Shaftesbury	Cullompton	Killerton	Newton Abbot	Princetown	Tavistock	Redruth	Portland Bill	Weymouth	Exmouth
0-19													10		
20-39												4	13	3	
40-59												4	23	0	
60-79												4	17	0	
80-99						3						4	17	7	3
100-119						0			6	10		19	10	7	4
120-139		8	5		3	10			24	5	7	42	10	47	6
140-159	10	42	5		17	14	4	11	29	35	17	19		20	36
160-179	24	17	25	20	27	38	17	24	18	20	42	4		10	18
180-199	33	25	35	40	27	28	55	38	23	15	31			6	3
200-219	30	8	30	25	23	7	14	17		15	0				
220-239	0			15	0		7	10			3				
240-259	3				0		3								
260-279					3										
Years	30	12	20	20	30	29	29	29	17	20	29	26	30	30	28

Days	Ilfracombe	Paignton	Plymouth	Mount Batten	Salcombe	Sidmouth	Teignmouth	Torquay	Woolacombe	Bude	Falmouth	Fowey	Newquay	Penzance
0-19	14													4
20-39	22							4	11	4	8		3	21
40-59	7							4	11	0	0		0	7
60-79	18		3	4	16		13	11	6	0	32	11	7	25
80-99	14	7	10	14	10	3	7	14	33	0	24	11	0	7
100-119	14	3	20	29	16	10	27	21	17	0	0	12	17	11
120-139	11	23	40	29	32	24	27	32	22	21	36	31	33	25
140-159		37	20	19	16	21	23	7		21		31	33	
160-179		27	4	5	10	31	3	0		33		4	4	
180-199		3	3			7		7		17			3	
200-219						4				4				
220-239														
240-259														
260-279														
Years	28	30	30	21	19	29	30	28	18	24	25	26	30	28

The above table sets out the results of this analysis. At first sight it might appear that apart from seven exceptions no station has a predominate frost period.

The exceptions are

Plymouth	40%	of frost periods	120-139	days	in	length
Weymouth	47%	" "	120-139	"	"	"
Redruth	42%	" "	120-139	"	"	"
Cannington	42%	" "	140-159	"	"	"
Tavistock	42%	" "	160-179	"	"	"
Holton Heath	40%	" "	180-189	"	"	"
Cullompton	55%	" "	180-189	"	"	"

Arranged thus according to the length of their predominate periods, it might be noted that they are also arranged according to their mean deviation. The grouping is in periods of 20 days. If however periods of forty days are considered - and it is conceivable that such an enlarged grouping may be of practiced agricultural interest - then the proportions of frosts falling within such periods is greatly increased. For example, Fowey can reckon on slightly over three in every five years having a frost period of 120 to 160 days whilst Barnstaple, with three periods outstanding, has 77 per cent. of its frost periods between 160 to 220 days in length. And so it is possible to carry out similar analyses for all the other stations allowing for the most suitable degree of latitude in the grouping as required by the local agriculture.

Frequency of dates of last frost

It is not enough to know the most frequent length of a frost period. The placing of that period is perhaps even more important. In order to go a step further in fitting the frost period into the agricultural year, the percentage of occasions when the last frost occurs between given dates was calculated.

Table IV

Percentage Occasions when Last Frost occurs between given dates

	Jan. 1-15	Jan. 16-31	Feb. 1-14	Feb. 15-28	Mar. 1-15	Mar. 16-31	Apr. 1-15	Apr. 16-30	May 1-15	May 16-31	June 1-15	June 16-30	Years
Bath						10	10	41	24	15			41
Cannington						31	15	23	16	15			13
Long Ashton						10	14	29	33	14			21
Holton Heath							14	43	19	24			21
Shaftesbury						13	17	50	10	10			30
Barnstaple					3	15	13	45	12	12			40
Cullompton						3	0	64	20	13			30
Killerton						3	20	37	23	17			30
Newton Abbot					6	29	12	41	6	6			17
Princetown				4	0	14	14	50	9	9			22
Tavistock					6	17	7	47	13	10			30
Ellbridge					7	8	0	39	23	23			13
Redruth		3	3	4	15	37	15	19	0	4			27
Weston-super-Mare			6	7	7	27	27	20	0	6			15
Portland Bill	3	6	12	18	29	23	6	3					34
Weymouth		3	3	0	19	26	23	23	3				31
Exmouth				7	11	32	25	25					28
Ilfracombe	7	8	11	11	33	19	11						27
Paignton		3	3	0	4	32	29	26	3				31
Plymouth	2	0	5	3	17	28	25	17	3				36
Mt. Batten		5	5	0	24	38	14	14					21
Salcombe		5	5	5	10	35	25	15					20
Sidmouth				5	6	28	22	39					18
Teignmouth	3	3	3	4	13	45	16	13					31
Torquay		7	7	4	21	41	7	7	3	3			29
Woolacombe	4	5	9	14	27	32	9						22
Bude		4	0	4	11	7	11	45	7	11			27
Falmouth		4	4	11	39	31	11						26
Fowey	3	0	3	4	14	31	28	17					29
Gulval	6	0	0	12	18	29	6	29					17
Newquay		3	0	0	13	32	26	23	0	3			31
Penzance	4	7	7	15	33	26	8						27

Two periods are outstanding. Of the 32 stations so analysed fourteen show a marked preponderance towards frost between March 16 and 31 and twelve have a greater number from April 16 to 30 than at any other of the periods selected. As with the percentage frequency of frost periods a combination of two periods, making a monthly division can show some remarkable results. Thus Shaftesbury has 67 per cent. of its last frosts between April 1 - 30, Paignton 61 per cent. between March 16 and April 15 and Cullompton 84 per cent. between April 16 and May 15. It will be noted that none of the stations show a maximum of last frosts during any period earlier than March 1 in spite of the fact that the average date of last frost may occur earlier as is the case with Ilfracombe and Portland Bill where the last frost occurs on the average on February 25 and 28 respectively. Thus whilst the last frosts may occur scattered over the first two months of the year, thereby throwing the weight of their accumulated dates on to the side of an early average date, the table does show that certain periods predominate as those in which the last frosts are most likely to occur. Although not included in the table owing to the small number of years of observations available, the case of Sheepstor, on Dartmoor, is perhaps worth mentioning as an example of what can happen in a frost hollow even in this part of the country.

Percentage Occasions of Dates of Last Frosts at Sheepstor, Devon

	Jan. 1-15	Jan. 16-31	Feb. 1-14	Feb. 15-28	Mar. 1-15	Mar. 16-31	Apr. 1-15	Apr. 16-30	May 1-15	May 16-31	June 1-15	June 16-30
Sheepstor	0	0	0	0	0	0	0	17	25	33	17	8

With no last frosts occurring before April 16 and with one in twelve coming as late as the second half of June it is interesting to notice that the majority of last frosts occur at Sheepstor during the period of May 16 to 31 which is the absolute limiting period for all other stations.

Screen Frosts

Temperatures recorded in Stevenson screens at 4 ft. above the ground are not necessarily comparable with those in the first 2 to 3 ft. and so are not directly indicative of the conditions under which much of our agricultural produce is grown. Nor are they representative of the temperature of the air surrounding the leaves, blossom and young fruit in the orchard. Nevertheless they are standard readings of the temperature of the free air and as such are directly comparable. For that reason the numerous screen temperature records of the south-west peninsula have been used to construct a general picture of the frost situation in that area. In using these data it is necessary to remember that they are screen records and take no account of those frosts - ground frosts - which may be confined to the lowest few inches of the atmosphere and are not recorded at screen level.

A calculated figure giving the average number of occasions when frosts occur during each individual month (Table "A" of the Appendix) is no doubt of use to the agriculturalist in that it gives him some idea of the tendency of any particular station towards frost occurrence. A more complete summary of frost conditions however is that contained in Table "B" in the Appendix, of which Table V below, giving two selected stations, is an extract.

Table V

Months in 20 years when the Number of Screen Frosts falls within given groups at Bath and Bude

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath												
0	1	0	1	3	10	20	20	20	20	5	1	0
1-3	0	1	0	11	9	0	0	0	0	14	7	2
4-7	5	8	10	5	1					1	7	5
8-11	6	2	3	1	0					0	5	4
12-15	1	5	6	0							0	6
16-19	4	3	0									2
20-23	2	1										1
24-27	1	0										0
28-31	0											

Table V (continued)

Months in 20 years when the Number of Screen Frosts falls within given groups at Bath and Bude

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bude												
0	1	1	0	6	14	20	20	20	20	16	5	2
1-3	7	7	5	10	5	0	0	0	0	4	10	3
4-7	4	3	9	3	1					0	4	8
8-11	2	6	5	11	0						1	5
12-15	5	1	1	0							0	1
16-19	0	2	0									0
20-23	1	0										
24-27	0											
28-31												

Each month has been divided into periods of four days which, in effect, represent groups of frost occasions, since usually a day is credited with only one frost. To these groups 0 has been added to isolate those months when no frosts are observed. Thus the first column represents groups of frost occasions. Then using the period 1927 to 1946 and dealing with each month in turn, the number of years falling into each group was counted and the percentage calculated. Taking Bude above as an example it is seen that 5 per cent., or one January in twenty, has no screen frosts at all whilst 35 per cent. of Januaries have but one to three frosts and so on to the extreme case of one January in twenty experiencing as many as 20 to 23 screen frosts during the month. The usefulness of this percentage frequency data in placing the average number of occasions of screen frost in the correct perspective is shown by the following. Bude experiences, on the average, seven frosts in January, but the frequency table shows that the most frequent number of frosts occuring during that month is only 1 to 3 which is the case in seven years out of every twenty. Again, in the case of Bath it is seen that during February the predominant period is 4 to 7 which occurs two years in five, but the average for that month is much higher being 10.8 occasions of screen frost.

As an index of the comparative severity of the three months of winter, December, January and February, the percentage occasions when each month had twelve or more days of screen frost were calculated.

Table VI

Percentage frequency of twelve or more Screen Frosts per month

Inland stations	Dec.	Jan.	Feb.	Coastal stations	Dec.	Jan.	Feb.
Cannington	31	45	44	Weymouth	10	35	20
Long Ashton	35	45	55	Ilfracombe	5	5	5
Holton Heath	45	50	45	Plymouth Hoe	10	20	10
Cullompton	45	50	50	Sidmouth	16	35	25
Shaftesbury	55	45	55	Teignmouth	5	20	10
Killerton	39	40	50	Torquay	10	20	10
Newton Abbot	25	30	25	Exmouth	15	35	25
Tavistock	10	30	30	Falmouth	0	15	5
Barnstaple	10	40	25	Gulval	5	10	5
Bath	45	40	45	Newquay	5	15	5
Princetown	44	67	73	Bude	10	30	15
Redruth	8	8	8	Penzance	0	0	5
Ellbridge	21	28	28	Portland Bill	0	18	6
				Paignton	12	19	6
				Mount Batten	6	25	12
				Seaton	26	47	26
				Fowey	5	17	0
				The Lizard	0	0	0

Table VI has been constructed in two parts in order to separate the coastal stations from those situated inland. One very obvious difference brought out by this segregation of the two types of station is the much higher frequencies

applicable to the inland stations than to those on the coast - a statistical verification of a very well known fact. Considering the inland stations above it is noticeable that whilst in most cases January and February show higher frequencies than does December, yet the three months are sufficiently close together to warrant inclusion within the same regime. It would seem that winter, in so far as frosts can represent that season, begins away from the coast with the coming of December. Two places in the above table are exceptions to this statement. Tavistock and Barnstaple fit into the general scheme well enough as far as January and February are concerned but fail to do so in December with much smaller frequencies. Apparently the moderating influence of the sea air staves off the onset of winter until the beginning of the new year. The coastal stations in the second part of the table, without exception show relatively small frequencies in December, increasing to much larger ones in January and then falling off equally rapidly to small frequencies in February. Their winters are short; in fact January can almost be regarded as the winter season. December and February are more rightly included with the transitional periods when the coastal area is gradually succumbing to winter's onslaught and then starting to make its rapid recovery. From an agricultural point of view the months in which the occurrence of frosts is of the greatest importance are April and May. Fig. VIII sets out in graphical form the percentage frequency with which frosts occur during those months. The histograms are arranged in two sections with the inland stations grouped together on the left and the coastal stations on the right.

As might be expected the inland stations suffer many more frosts than do the coastal stations during both months whilst the extreme south-west and Ilfracombe are entirely free from frosts in April, this free area extending further east in May. One other point is worth noting. With the single exception of Princetown, no station has twelve or more frosts in April or eight or more in May.

Fig. IX summarises in map form the data contained in the histograms for May in Fig. VIII. The isopleths are based on the number of May months during the last 20 years when the absolute minimum has dropped on at least one occasion to 32°F. or below in the screen. Naturally it has not the detailed information of the histograms, but has the advantage of showing at a glance the approximate chances of a particular area having any screen frosts in May. Thus agriculturalists in central Devon and in the extreme east of the area can plan on the assumption that, on the average, they must expect May screen frosts every other year whilst those in the coastal area of Cornwall can reasonably suppose that frosts in May are phenomena which occur about once in twenty years.

Ground Frosts

Whilst the distribution in time and space of screen frosts has valuable implications, of far greater interest to horticulturalists are those frosts recorded by the grass minimum thermometer placed with its bulb touching the tips of closely cut grass, since they are more truly representative of temperature conditions within those first few inches of the atmosphere where most plants live. Ground frosts are recorded when the grass minimum thermometer shows that the temperature has fallen to 30.4°F. or below, and as a comparison between the following data and that previously given for screen conditions will show ground frosts are more numerous than screen frosts and can occur over a larger part of the year. Indeed Killerton and Tavistock, which have no screen frosts from the beginning of June to the end of September, have recorded ground frosts during every month of the year some time during the last twenty years.

Table VII

Average number of Screen and Ground Frosts

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Total
Killerton													
Screen	11.4	10.5	8.9	3.2	1.4	0.0	0.0	0.0	0.0	1.3	5.8	9.4	51.9
Ground	17.5	17.2	16.3	10.7	6.2	2.2	0.06	0.2	1.9	5.2	11.3	15.6	104.36
Tavistock													
Screen	9.6	8.5	5.9	2.4	0.6	0.0	0.0	0.0	0.0	1.1	4.6	7.6	40.3
Ground	15.2	14.5	13.7	11.2	5.6	1.6	0.3	0.3	2.2	6.5	11.6	14.8	97.5

Reference to the total yearly averages will show that for every screen frost recorded at least two ground frosts occur. Percentage frequency tables showing the occurence of ground frosts have been constructed in exactly the same way as were those for screen frosts (Table "C" (Appendix)). When the two sets of frequency tables for screen and ground frosts are compared, the greater persistence of the ground frosts is very evident. To illustrate this more clearly the following composite table of the first six months of the year at Long Ashton has been constructed.

Table VIII

Percentage Frequency of Screen and Ground Frosts at Long Ashton

Occasions	January.		February		March	
	Screen	Ground	Screen	Ground	Screen	Ground
0	5.0	0.0	0.0	0.0	5.0	0.0
1-3	0.0	0.0	10.0	0.0	0.0	0.0
4-7	25.0	5.0	35.0	5.0	35.0	10.0
8-11	25.0	5.0	0.0	15.0	25.0	10.0
12-15	10.0	40.0	30.0	25.0	20.0	40.0
16-19	15.0	20.0	15.0	40.0	15.0	15.0
20-23	10.0	15.0	5.0	10.0	0.0	25.0
24-27	10.0	15.0	5.0	5.0	0.0	0.0
28-31	0.0	0.0	0.0	0.0	0.0	0.0

Occasions	April		May		June	
	Screen	Ground	Screen	Ground	Screen	Ground
0	25.0	0.0	45.0	15.0	100.0	85.0
1-3	45.0	5.0	50.0	35.0	0.0	15.0
4-7	20.0	35.0	5.0	40.0	0.0	0.0
8-11	10.0	35.0	0.0	5.0	0.0	0.0
12-15	0.0	15.0	0.0	5.0	0.0	0.0
16-19	0.0	5.0	0.0	0.0	0.0	0.0
20-23	0.0	5.0	0.0	0.0	0.0	0.0
24-27	0.0	0.0	0.0	0.0	0.0	0.0
28-31	0.0	0.0	0.0	0.0	0.0	0.0

When the percentage frequencies of twelve or more ground frosts per months are calculated the result is even more startling than for the same analysis of screen frosts in Table "B" (Appendix). The very great difference between inland and coastal conditions is well exemplified by Table IX.

Table IX

Percentage Frequency of Occasions (months) with twelve or more Ground Frosts

Inland stations	Dec.	Jan.	Feb.	Coastal stations	Dec.	Jan.	Feb.
Cannington	65	71	59	Ilfracombe	5	10	15
Long Ashton	65	90	80	Paignton	54	54	39
Holton Heath	79	75	80	Plymouth	26	35	35
Cullompton	83	90	90	Mount Batten	11	34	22
Killerton	67	75	84	Sidmouth	29	47	53
Newton Abbot	70	57	60	Teignmouth	7	27	20
Princetown	56	69	59	Torquay	40	40	20
Tavistock	85	75	65	Falmouth	16	26	16
				Gulval	25	20	10

Whilst the three months of winter appear to be equally liable to twelve or more ground frosts at the inland stations, this is not so consistently true on the coast. In all the cases quoted above, with the exception of Ilfracombe, Plymouth and Sidmouth there is a pronounced drop in February, while in several other cases the difference between December and January is considerable. Paignton and Torquay are noteworthy for their high frequencies. These apparent anomalies together with the lack of consistency among the coastal stations are presumably directly related to the individual exposures. The elucidation of these points, however, calls for a much more detailed analysis of each station and is beyond the intended scope of this present work.

Owing to the fact that they occur at a time when crops are beginning to grow and are therefore in a less resistant stage, spring frosts, whether ground or air frosts, are far more dangerous though numerically less important, than those in winter. The average occurrence of ground frosts during autumn, winter and spring is set out in the following table of selected stations.

Table X

Average Number of Ground Frosts during the Frost Seasons

	Spring	Autumn	Winter
Cannington	27.9	13.6	41.9
Long Ashton	28.0	17.4	47.3
Holton Heath	31.1	17.3	48.5
Cullompton	32.7	22.8	51.5
Ilfracombe	4.2	0.5	13.2
Killerton	33.2	18.4	50.3
Newton Abbot	23.1	11.8	42.9
Paignton	18.9	9.4	33.7
Plymouth	12.2	5.5	24.8
Mount Batten	14.6	5.6	22.6
Princetown	18.2	9.6	43.6
Sidmouth	13.0	5.1	32.6
Tavistock	30.5	20.3	44.5
Teignmouth	7.6	1.9	22.0
Torquay	10.6	4.9	25.8
Falmouth	11.4	5.6	23.2
Gulval	12.1	5.0	21.7

N.B.
Spring = March-May
Autumn = Sept.-Nov.
Winter = Dec.-Feb.

Ground frosts can be devastating in their effects. It is important therefore to realise that the average dates of last screen frosts, noted earlier in this discussion, are more of an academic value to the climatologist than of a practical value to the agriculturalist except in so far as they are an indication of the approximate end of the main air-frost period. Killing frosts, to use the American term, can however occur several weeks after that average date. Taking the case of Ilfracombe, it is seen that although the average date of last screen frost is February 25, 90 per cent. of the months of March, 20 per cent. of the months of April and 10 per cent. of the months of May, all have ground frosts, and that even in the screen one March in four has from one to three days on which temperatures as low as from 25°- 29°F. are recorded. A more extreme case is that of Killerton. The average date of the last screen frost is April 27. Ground frosts have occurred however during every month of the year with June showing 47 per cent. of occasions of ground frost and as many as 6 per cent. of the months of June having 8 - 11 ground frosts. Moreover 25 per cent. of occasions have from 1 - 3 days with temperatures between 25° and 29°F.

Low Screen Temperatures

It has previously been noted that the freezing point of water, 32°F., as measured in the Stevenson screen, has no special significance when directly applied to the reactions of normal temperate vegetation. Most plants can withstand such a temperature without suffering any serious damage. It is when screen temperatures below 30°F. are recorded that the real trouble begins. Even so the time of the year must also be taken into consideration. Obviously temperatures below 30°F. are of only restricted interest to the fruit grower during January, but those same temperatures during March, April and May, when just one night of low temperatures can ruin his whole crop, become of vital importance to him. South-west England is an area of mild winter climate where plant growth begins earlier than elsewhere in this country, and is, as a result, a region where the growth of early vegetables, flowers and fruits forms an important part of farm economy. Consequently, low temperatures at almost any time in the year can either do damage or seriously disrupt farming operations. Short periods of low temperatures, occasional nights of hard frosts that is, are not in general of very great importance during December, except perhaps to the fruit grower who may find his spraying operations interrupted. Long periods

of low temperature can however, even during these months, do considerable damage to vegetables in clamps or exposed storage barns. Given suitable facilities, it is possible to guard against such a contingency. Outside these two months when late crops are waiting to be gathered or early crops planted and perhaps beginning to grow, abnormally low temperatures become a matter for very serious consideration. In attempting to reduce the analysis down to critical limits, the investigator is not only confronted by the wide range of plant susceptibility to frost but also by a divergence of opinion among the experts as to what those limits are in individual cases. To quote the case of frost damage to fruit trees, "there is considerable difference of opinion among workers as to danger temperatures ..... This divergence of opinion seems to indicate that there is no one temperature which is universally fatal to fruit blossom. As regards apples, of six American authorities three regard 27°F. and three 25°F. as the danger point for buds showing colour; for open blossom opinion is equally divided between 28°F. and 29°F., while during setting temperatures from 30° to 28°F. all have advocates,"*

Using the minimum temperature records and ignoring all temperatures of 30°F. and above, Table "D" in the Appendix shows the percentage frequency of the periods of low temperatures monthly. The method of presentation is the same as that adopted for the previous period frequency tables. Table XI for Bath is an extract from the main table in the Appendix.

Table XI

Percentage Frequency of Screen Temperatures Less than 30°F. at Bath

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	0.0	5.0	5.0	60.0	90.0	100.0	100.0	100.0	100.0	75.0	15.0	15.0
1-3	40.0	35.0	45.0	40.0	10.0	0.0	0.0	0.0	0.0	20.0	60.0	10.0
4-7	20.0	20.0	30.0	0.0	0.0					5.0	25.0	35.0
8-11	10.0	30.0	20.0							0.0	0.0	30.0
12-15	15.0	5.0	0.0									10.0
16-19	10.0	5.0										0.0
20-23	0.0	0.0										
24-27	5.0											
28-31	0.0											

Thus Bath can expect in every January at least one occasion when the screen thermometer will register below 30°F. and in 30 per cent. of years has eight or more occasions when temperatures reach this low level.

The influence of sea conditions in warding off such low temperature conditions from coastal areas is well exemplified by Table XII in which the percentage frequency of nil occasions of less than 30°F. during the six main frost months is quoted.

* "Spring Frost Damage in Orchards and its Possible Prevention". Tech. Commun. Bur. Hortic. Plant. Crops, East Malling, No. 15, 1945.

Table XII

Percentage Frequency at Coastal and Inland stations of Nil occasions of Screen Temperatures below 30°F.

	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.
Inland						
Bath	0	5	5	60	15	15
Cannington	21	16	11	68	53	10
Long Ashton	10	25	10	70	35	10
Holton Heath	5	5	5	45	15	10
Cullompton	5	10	5	50	20	10
Shaftesbury	15	10	20	80	50	5
Killerton	5	15	5	50	15	15
Newton Abbot	25	25	25	85	70	20
Ellbridge	11	11	5	58	37	21
Barnstaple	5	20	0	60	25	15
Princetown	0	6	5	58	53	5
Tavistock	5	5	20	65	40	15
Coastal						
Weymouth	25	35	35	90	80	25
Ilfracombe	70	55	75	100	100	60
Gulval	55	55	60	100	95	60
Newquay	55	55	60	100	90	40
Bude	25	40	30	70	40	25
Penzance	70	80	85	100	100	80
Torquay	35	40	40	100	80	45
Exmouth	35	25	35	90	60	10
Falmouth	65	55	75	100	100	65
Fowey	44	55	61	100	83	50
Plymouth	40	40	55	100	80	45
Sidmouth	20	35	30	95	60	20
Teignmouth	30	45	45	100	80	30

Certain anomalies present themselves in the above table. Cannington and Newto Abbot appear to tend towards a coastal regime whilst Bude and Sidmouth, although on the coast, would seem to suffer from the influences of their colder hinterlands.

The relative practical importance of the various values in Table XII and in the more comprehensive Table "D" in the Appendix, is difficult to assess since the susceptibility of differing farms and areas to frost damage is necessarily dependent upon the type of agriculture practiced. For instance the values for Bath in Table XI show that two out of every six months of April are liable to temperatures of less than 30°F. on from one to three days, and that every January has at least one recording below 30°F., and May, one year in twenty, has as many as 24 to 27 days reading as low. Obviously the importance which might be attached to these and all other similar comparisons must necessarily be defined by the needs of the branch of agriculture to which they are applied.

Absolute Minimum Temperatures

As a further analysis of low temperatures to link up with the above data concerning temperatures below 30°F. the absolute screen minimum temperatures recorded for each month over twenty years were extracted and analysed. As a first step the monthly means of the absolute minimum temperatures were calculated and are given in Table XIII. The data contained in this table are a measure of the average lowest levels to which temperatures will normally drop at least once during a given month and as such should prove of value to horticulturalists.

Table XIII

Monthly Means of Absolute Screen Minimum Temperatures (1927-46) in Fahrenheit

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath	22.4	23.5	24.5	30.3	33.2	41.5	45.9	43.9	38.1	31.1	26.6	23.9
Long Ashton	23.1	24.0	25.0	30.3	32.5	40.2	44.2	43.2	37.4	31.7	27.3	24.1
Cannington	23.6	25.3	25.7	31.2	35.1	41.8	46.5	44.9	39.1	31.2	27.8	25.4
Holton Heath	21.7	23.5	23.7	29.0	32.1	39.5	43.3	42.3	36.7	30.5	26.3	23.9
Shaftesbury	24.0	24.1	25.8	30.7	34.5	42.4	46.0	45.5	41.0	34.4	30.3	24.5
Cullompton	21.9	22.9	23.6	29.4	32.5	39.0	42.7	41.9	36.1	31.0	25.9	23.7
Killerton	22.8	24.8	25.3	29.5	32.7	39.3	42.7	42.3	36.5	31.7	26.0	25.1
Newton Abbot	26.3	26.3	27.6	32.5	35.2	42.1	46.1	45.3	40.5	35.3	30.6	26.9
Tavistock	24.7	25.5	26.0	30.5	33.7	40.0	43.1	43.1	38.5	33.4	28.7	24.7
Princetown	23.7	23.4	25.3	29.7	33.3	40.5	42.2	45.2	40.1	34.0	29.7	24.9
Redruth	30.5	29.2	29.9	33.8	38.0	44.5	48.6	48.3	43.5	38.1	33.7	30.0
Portland Bill	31.0	30.3	30.4	37.1	39.8	47.5	52.5	53.5	47.0	40.5	36.1	31.1
Ilfracombe	30.5	30.7	31.8	37.3	40.3	47.3	51.9	51.6	47.8	41.6	38.4	31.3
Newquay	28.8	28.9	29.5	34.3	37.1	43.3	47.5	47.5	44.5	37.8	32.9	29.2
Sidmouth	26.4	26.7	27.9	32.9	35.8	42.6	47.0	46.6	41.4	35.8	30.3	27.5
Teignmouth	27.8	28.1	29.1	34.4	38.1	45.1	48.5	48.5	43.1	36.9	32.1	28.5
Torquay	27.7	28.3	29.1	34.7	37.2	44.9	48.4	48.3	43.3	36.7	31.9	28.8
Paignton	26.2	27.8	28.1	32.7	36.8	44.1	47.7	46.8	41.7	34.7	31.5	26.6
Plymouth	27.9	28.1	29.1	34.5	37.9	44.9	48.6	48.1	43.1	37.3	31.7	28.1
Mount Batten	28.5	28.6	28.9	34.5	37.1	43.9	47.3	47.3	42.7	37.1	32.2	28.5
Falmouth	30.1	30.1	31.3	35.9	38.9	46.0	49.5	49.8	45.0	39.3	34.9	31.2
Fowey	28.6	29.3	29.3	37.1	37.1	44.1	47.5	47.5	42.5	36.9	32.4	29.0
Gulval	29.7	30.3	30.5	34.7	37.7	43.8	48.8	47.7	43.3	38.1	34.1	30.4
The Lizard	31.3	30.9	33.4	37.0	40.0	45.5	49.6	49.6	46.7	40.9	37.0	32.3

The above list of stations is arranged according to position, relative to the sea. The first eleven stations are all inland and the rest, beginning with Portland Bill, are on the coast. The difference in the two temperature regimes is well marked but certain stations depart somewhat from the general values which characterise their own group. Shaftesbury, Newton Abbot, Tavistock and Redruth are all a few degrees warmer in winter than the other inland stations. This is no doubt accounted for by their altitudes, which are 680 ft., 375 ft., 457 ft. and 397 ft. respectively. Nights of excessively low temperatures are usually those of extreme radiation and the pooling of cold air at the lower levels. The above stations, by virtue of their altitude, are above the level of the accumulated cold air and no doubt there is sufficient movement of air, even on the calmest nights in the valleys, to reduce the effect of radiation. Amongst the coastal stations Sidmouth and Paignton stand out as anomalies in that they have lower absolute minimum temperatures during the frost months. Both these stations have been previously mentioned as having lower temperatures than their positions warrant, and it has been suggested that this may be the result of their being in the path of cold air flowing from the higher ground inland.

As a further indication of the fluctuations of low temperatures in south-west England the highest and lowest absolute screen minimum temperatures recorded are given in Table XIV.

Table XIV

Range of Absolute Screen Minimum Temperature in Fahrenheit (1927-46)

	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Bath	33	5	30	8	34	20	36	26	40	28	46	38	50	41	52	38	45	35	39	28	34	21	32	18
Long Ashton	33	8	30	7	33	18	34	25	38	25	45	36	49	41	50	38	43	33	36	28	33	21	32	18
Cannington	33	4	35	6	30	21	36	24	41	29	48	37	50	40	50	39	44	36	39	24	35	22	39	21
Holton Heath	32	8	30	10	31	19	35	22	38	27	42	35	50	40	49	39	43	32	37	25	31	21	33	18
Shaftesbury	31	9	32	15	34	19	36	26	42	27	48	39	50	41	50	39	48	35	42	29	36	27	38	19
Cullompton	30	2	31	12	30	18	34	25	38	28	45	30	48	38	49	37	43	33	38	23	32	21	34	17
Killerton	29	3	31	12	31	20	35	25	43	28	44	34	47	39	50	37	41	29	39	23	33	20	38	21
Newton Abbot	32	15	32	17	34	20	37	29	43	26	47	38	50	42	52	40	46	35	40	32	38	25	40	19
Tavistock	31	13	32	19	32	19	37	26	41	28	45	35	47	39	50	38	45	34	39	27	35	23	37	18
Princetown	29	13	30	14	33	17	35	23	38	26	45	37	49	40	48	42	46	36	41	28	36	24	35	16
Redruth	35	24	36	24	35	24	38	31	43	32	47	41	53	46	52	43	47	42	42	31	37	30	39	23
Portland Bill	36	20	40	23	39	21	45	32	45	32	50	45	54	50	59	50	53	40	52	30	43	29	43	23
Ilfracombe	37	19	37	22	37	26	43	34	45	35	50	43	56	49	55	47	52	42	46	34	40	32	43	25
Newquay	35	19	37	21	35	23	40	31	41	32	47	40	52	44	52	44	49	39	45	28	39	28	40	22
Sidmouth	33	15	32	17	33	22	38	30	40	31	47	39	50	44	53	42	47	36	41	32	37	27	40	22
Teignmouth	35	15	33	21	35	25	39	30	45	33	50	40	52	45	55	44	47	40	42	31	39	27	41	22
Torquay	33	16	35	23	36	24	40	30	43	31	49	40	52	46	55	43	49	39	43	31	38	28	38	23
Paignton	33	15	32	23	34	24	37	29	43	31	48	40	50	45	54	42	46	39	40	29	36	26	36	22
Plymouth	34	16	34	21	35	22	40	30	44	31	49	40	52	44	53	43	48	37	43	31	37	23	39	21
Mount Batten	38	17	33	21	34	24	39	31	43	31	48	35	51	45	52	43	48	38	42	32	38	25	40	23
Falmouth	36	21	36	23	39	23	40	33	46	30	50	41	55	41	53	44	49	39	46	33	40	31	41	22
Fowey	34	13	34	23	34	24	44	30	44	32	49	38	52	43	54	40	48	37	43	30	38	27	38	22
Gulval	38	21	38	25	36	25	40	31	42	33	50	39	59	45	51	42	47	40	42	29	39	29	36	21
The Lizard	37	22	35	24	40	30	41	32	45	32	50	43	53	47	53	47	52	39	45	35	42	33	45	23

It will be seen that the very low temperatures are confined to the inland stations, but nevertheless every coastal station has experienced quite low minima during the last 20 years. In using Table XIV it must be remembered that it is a table of absolute extremes of temperature. Thus the range over which the absolute screen minimum temperature might be found in January is from 33° - 5°F. Just knowing the bare limits of the absolute minima is not enough. Table E of the Appendix was constructed in order to present a more detailed analysis of these low temperatures. It is a table of percentage frequencies of the absolute minimum screen temperatures. Table XV is an extract from the main table to illustrate the method of presentation.

Table XV

Percentage Frequency of Absolute Screen Minimum Temperatures at Shaftesbury

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
°F.												
< 20	25.0	15.0	15.0									20.0
20-24	15.0	35.0	35.0	0.0	0.0					0.0	0.0	30.0
25-29	45.0	40.0	40.0	25.0	5.0					5.0	50.0	45.0
30-32	15.0	10.0	10.0	65.0	15.0	0.0	0.0	0.0	0.0	25.0	35.0	0.0
> 32	0.0	0.0	0.0	10.0	80.0	100.0	100.0	100.0	100.0	70.0	15.0	5.0

The groupings of temperature were chosen deliberately. The two bottom groups of the table segregate those temperatures of 30°F. or above which, as before mentioned, are not normally dangerous to plant growth. The crucial temperature at which plant injury commences is somewhere in the middle twenties, but no hard and fast limit can be laid down since there is a great variation in plant reactions to low temperatures dependent not only upon the species but also upon the condition of the plant with respect to stage of growth, bud development and state of early fruit at the time of the low temperature. In view of this, two groupings of temperature were decided upon. Frosts occuring at temperatures between 25°F. and 29°F. may or may not result in injury to plant growth, dependent upon the conditions set out above. Between 20°F. and 24°F. however considerable damage is certain. A further grouping of temperatures below 20°F. has been included since frosts at these temperatures will not only

cause heavy damage to field crops but also penetrate cold frames, inadequate outdoor storage clamps, barns and cattle sheds. Thus at Shaftesbury it was found that 25 per cent. of the absolute minimum temperatures recorded in the twenty months of January were below 20°F. In other words the lowest temperature recorded during one January in every four is below 20°F. It is true that the absolute minimum temperature occurs only once a month and that all other minimum readings during that month may not even approach such low levels but nevertheless just one occasion of such extreme frost, which in itself also indicates several hours of temperatures below freezing level, is often sufficient to cause irreparable damage to crops.

On the assumption that 24°F. is the upper limit of certain large-scale damage the following Table XVI has been constructed. All available stations reporting absolute minimum temperatures are included but the months from May to September inclusive are omitted since no station has recorded such low temperatures during the period analysed.

Table XVI

Percentage Frequency of Absolute Screen Minimum Temperatures below 25°F.

	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.
Bath	55	55	50	0	5	30	60
Long Ashton	45	55	35	0	5	30	50
Cannington	47	45	29	6	6	28	59
Holton Heath	70	50	65	5	0	26	53
Shaftesbury	40	50	35	0	0	0	50
Cullompton	65	60	65	0	5	45	75
Killerton	55	39	42	0	5	32	53
Newton Abbot	30	35	10	0	0	0	25
Tavistock	35	42	32	0	0	15	50
Princetown	41	23	38	5	0	5	42
Redruth	15	8	8	0	0	0	17
Portland Bill	10	15	15	0	0	0	5
Ilfracombe	5	5	0	0	0	0	0
Newquay	20	25	10	0	0	0	20
Sidmouth	30	35	16	0	0	0	20
Teignmouth	26	21	0	0	0	0	15
Torquay	15	15	5	0	0	0	15
Paignton	15	8	8	0	0	0	25
Plymouth	20	15	15	0	0	5	20
Mount Batten	20	10	5	0	0	0	15
Falmouth	10	10	10	0	0	0	10
Fowey	22	22	5	0	0	0	18
Gulval	10	0	0	0	0	0	5
The Lizard	14	7	0	0	0	0	7

As a commentary upon the possibility of low temperatures at the various stations, the above table clearly illustrates the great difference between conditions at inland and coastal stations. Thus Bath can reasonably expect at least one occasion when the temperature falls below 25°F. in each of the four months December to March, every other year, whilst Gulval will normally experience such temperatures one year in ten during January, one year in twenty during December and not at all during all other months. It is interesting to note that even those places most favourably situated are not totally immune from occasional very severe frosts.

The distribution, on a monthly basis, of absolute minimum temperatures below 30°F. is shown in Figs. X to XVII. Using the period of twenty years, isopleths were drawn through stations with the same number of occasions of temperatures below the given limit. In Fig. X for instance the number of years in twenty when the absolute minimum temperature in January has fallen below 30°F. are indicated. Thus the "18" line indicates that a very large portion of the peninsula experiences these low absolute minimum temperatures during at least eighteen months of January in every twenty. The months of June to September naturally do not appear in this series of charts since they are without any occasions of such low temperatures in the area under consideration.

In conclusion it must be pointed out that the foregoing is essentially a study of the low-temperature data available in south-west England. It aims at presenting this information in such a form as can be used not only by agriculturalists but also by future workers who may carry the study of frosts to its logical conclusion. No attempt has been made to correlate the temperature data with wind, humidity, exposure or aspect. All these must be given the full weight of their importance, relative to frost occurrence, in any future comprehensive work on the subject.

APPENDIX

TABLE A

Monthly Means of Occasions of Screen and Ground Frosts and Screen Temperatures less than 30°F. with Range (1927-46)

(a) Occasions (b) Range

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath													
Screen	(a)	11.9	10.8	8.5	2.7	1.0	0	0	0	0	1.6	5.3	10.4
	(b)	26-0	23-3	15-0	9-0	6-0					7-0	11-0	19-1
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	7.1	6.1	4.3	0.6	0.1	0	0	0	0	0.5	2.7	6.1
	(b)	24-0	17-0	10-0	3-0	2-0					6-0	7-0	12-0
Cannington													
Screen	(a)	11.7	9.1	8.4	1.8	0.6	0	0	0	0	0.8	3.3	8.4
	(b)	24-0	21-2	15-2	8-0	3-0					7-0	9-0	21-0
Ground	(a)	14.8	14.4	15.8	8.1	4.0	0.1	0	0	0.6	3.7	9.3	12.7
	(b)	25-8	23-7	21-6	19-1	11-0	1-0			3-0	11-0	17-3	22-1
< 30°F.	(a)	5.9	5.2	3.7	0.5	0	0	0	0	0	0.2	1.5	4.6
	(b)	21-0	14-0	10-0	3-0						1-0	7-0	16-0
Long Ashton													
Screen	(a)	12.9	11.2	9.2	2.7	1.1	0	0	0	0	1.8	5.4	9.8
	(b)	25-0	24-2	18-0	10-0	5-0					10-0	11-0	25-1
Ground	(a)	16.6	15.5	14.9	9.1	4.0	0.2	0	0	1.0	5.2	11.2	15.2
	(b)	27-7	24-6	22-5	21-2	12-0	2-0			5-0	12-1	20-4	26-5
< 30°F.	(a)	8.1	5.9	4.3	1.1	0.1	0	0	0	0	0.5	2.3	6.3
	(b)	24-0	18-0	11-0	6-0	4-0					6-0	9-0	17-0
Holton Heath													
Screen	(a)	13.3	11.3	10.4	3.7	1.3	0	0	0	0.5	1.9	6.2	10.3
	(b)	24-3	23-3	17-1	9-0	6-0				1-0	6-0	12-0	22-0
Ground	(a)	17.4	15.3	16.7	10.0	4.4	0.3	0	0.1	0.9	5.4	11.0	15.8
	(b)	28-8	24-6	27-10	22-2	10-0	3-0		1-0	4-0	14-1	16-4	25-3
< 30°F.	(a)	8.5	6.3	5.5	1.1	0.2	0	0	0	0	0.5	2.6	6.1
	(b)	21-0	18-0	12-0	4-0	2-0					4-0	6-0	11-0
Shaftesbury													
Screen	(a)	13.2	12.8	9.7	3.5	0.8	0	0	0	0	0.3	3.6	10.0
	(b)	28-1	27-1	20-0	10-0	6-0					2-0	10-0	23-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	7.8	6.8	4.4	0.3	0	0	0	0	0	0.1	1.1	6.1
	(b)	23-0	24-0	11-0	2-0						1-0	5-0	15-0
Weymouth													
Screen	(a)	8.5	6.7	4.7	0.6	0.1	0	0	0	0	0.1	1.8	6.5
	(b)	21-0	21-0	10-0	2-0	1-0					1-0	5-0	17-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	4.1	2.9	2.1	0.1	0	0	0	0	0	0	0.2	3.0
	(b)	16-0	14-0	8-0	1-0							1-0	11-0

TABLE A - continued

Monthly Means of Occasions of Screen and Ground Frosts and Screen Temperatures less than 30°F. with Range (1927-46)

(a) Occasions (b) Range

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cullompton													
Screen	(a)	12.7	10.9	9.5	3.7	1.5	0.1	0	0	0	1.8	6.5	11.0
	(b)	23-3	18-4	17-3	10-0	7-0	1-0				6-0	13-1	23-0
Ground	(a)	16.5	17.0	17.1	10.9	4.7	0.1	0	0.1	1.7	7.2	13.9	18.0
	(b)	30-0	24-4	25-10	22-3	13-0	1-0		1-0	8-0	18-0	23-5	27-8
< 30°F.	(a)	8.0	5.9	5.7	1.2	0.2	0	0	0	0	0.6	2.9	6.3
	(b)	19-0	20-0	12-0	6-0	3-0					5-0	8-0	16-0
Killerton													
Screen	(a)	11.4	10.5	8.9	3.2	1.4	0	0	0	0	1.3	5.8	9.4
	(b)	24-2	18-2	14-2	9-0	6-0					5-0	11-0	22-0
Ground	(a)	17.5	17.2	16.3	10.7	6.2	2.2	0.06	0.2	1.9	5.2	11.3	15.6
	(b)	30-0	25-9	26-3	17-4	16-0	9-0	1-0	3-0	7-0	23-0	20-1	28-3
< 30°F.	(a)	6.9	5.3	5.1	1.5	0.5	0	0	0	0	0.5	3.0	4.7
	(b)	18-0	20-0	10-0	11-0	3-0					4-0	14-0	16-0
Ilfracombe													
Screen	(a)	3.7	3.1	1.4	0	0	0	0	0	0	0	0.1	3.1
	(b)	18-0	14-0	7-0								1-0	14-0
Ground	(a)	5.0	4.1	3.7	0.3	0.2	0	0	0	0	0.1	0.5	4.1
	(b)	18-0	15-0	12-0	2-0	2-0					1-0	3-0	17-0
< 30°F.	(a)	1.4	1.2	0.5	0	0	0	0	0	0	0	0	0.7
	(b)	12-0	8-0	3-0									3-0
Newton Abbot													
Screen	(a)	8.5	7.9	5.6	1.5	0.4	0	0	0	0	0.1	2.3	7.6
	(b)	23-1	22-1	12-0	5-0	3-0					1-0	5-0	18-0
Ground	(a)	13.9	14.5	13.4	6.9	2.8	0.1	0	0	0.4	3.1	8.3	14.5
	(b)	26-0	26-4	28-7	13-1	11-0	1-0			5-0	13-0	21-1	27-0
< 30°F.	(a)	4.5	4.0	2.5	0.1	0.1	0	0	0	0	0	0.5	3.9
	(b)	17-0	21-0	8-0	1-0	1-0						3-0	14-0
Paignton													
Screen	(a)	7.5	5.1	5.5	0.9	0.1	0	0	0	0	0.3	1.9	6.5
	(b)	16-0	15-1	11-0	3-0	1-0					3-0	6-0	16-0
Ground	(a)	11.8	10.9	10.4	7.5	1.0	0	0	0	0	2.2	7.2	11.0
	(b)	17-6	18-6	16-5	12-1	4-0					5-0	14-2	15-2
< 30°F.	(a)	3.7	2.1	2.6	0.2	0	0	0	0	0	0.1	0.4	3.3
	(b)	13-0	8-0	6-0							1-0	2-0	8-0
Sidmouth													
Screen	(a)	8.6	7.6	5.2	0.8	0.3	0	0	0	0	0.3	2.3	6.7
	(b)	19-0	23-1	11-0	3-0	2-0					4-0	7-0	19-0
Ground	(a)	12.4	10.9	9.3	2.8	0.9	0	0	0	0	1.2	3.9	9.3
	(b)	25-5	23-1	21-1	12-0	7-0					5-0	10-0	22-0
< 30°F.	(a)	4.1	3.1	2.4	0.1	0	0	0	0	0	0.1	0.5	3.3
	(b)	16-0	14-0	7-0	1-0						2-0	2-0	9-0

TABLE A - continued

Monthly Means of Occasions of Screen and Ground Frosts and Screen Temperatures less than 30°F. with Range (1927 - 46)

(a) Occasions (b) Range

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Teignmouth													
Screen	(a)	5.9	5.0	4.2	0.3	0	0	0	0	0	0.1	1.1	5.1
	(b)	18-0	22-0	11-0	2-0						1-0	4-0	16-0
Ground	(a)	9.1	7.7	6.4	1.0	0.2	0	0	0	0	0.1	1.8	5.2
	(b)	17-1	23-1	13-0	4-0	2-0					2-0	5-0	14-0
< 30°F.	(a)	3.2	1.9	1.1	0	0	0	0	0	0	0	0.3	1.9
	(b)	15-0	13-0	5-0								2-0	9-0
Torquay													
Screen	(a)	6.8	5.4	4.4	0.4	0.2	0	0	0	0	0.1	1.4	5.0
	(b)	17-0	21-0	11-0	4-0	2-0					2-0	5-0	15-0
Ground	(a)	10.1	8.4	8.1	2.0	0.5	0	0	0	0	0.5	4.4	7.3
	(b)	21-2	18-3	19-2	8-0	4-0					2-0	8-0	16-0
< 30°F.	(a)	3.1	1.9	1.4	0	0	0	0	0	0	0	0.2	2.0
	(b)	14-0	10-0	7-0								1-0	8-0
Plymouth Hoe													
Screen	(a)	5.9	5.6	3.6	0.3	0.1	0	0	0	0	0.1	1.3	5.0
	(b)	17-0	20-0	8-0	2-0	1-0					1-0	4-0	15-0
Ground	(a)	9.2	8.5	8.0	3.3	0.9	0	0	0	0.1	0.8	4.7	7.1
	(b)	23-1	19-0	21-2	12-0	5-0				1-0	5-0	10-9	16-0
< 30°F.	(a)	2.7	2.3	1.0	0	0	0	0	0	0	0	0.2	2.2
	(b)	11-0	10-0	7-0								1-0	11-0
Plymouth (Mount Batten)													
Screen	(a)	6.7	6.0	5.9	~~5.6~~ 0.6	0.1	0	0	0	0	0.1	1.6	4.8
	(b)	19-0	21-1	13-1	5-0	1-0					1-0	5-0	17-0
Ground	(a)	7.9	8.6	8.6	3.9	2.1	0	0	0	0.2	1.0	4.4	6.1
	(b)	18-0	22-0	20-3	11-0	10-0				2-0	5-0	14-0	14-0
< 30°F.	(a)	1.9	1.5	1.2	0	0	0	0	0	0	0	0.1	1.2
	(b)	9-0	10-0	6-0								1-0	6-0
Princetown													
Screen	(a)	14.3	13.8	11.3	4.3	1.3	0	0	0	0	1.9	4.1	10.4
	(b)	26-2	24-4	24-0	15-0	9-0					12-0	11-0	22-0
Ground	(a)	15.9	14.3	11.7	4.9	1.6	0	0	0	0.1	2.6	6.9	13.4
	(b)	27-3	24-5	18-3	17-0	11-0				1-0	17-0	27-0	28-2
< 30°F.	(a)	8.6	9.2	5.3	1.4	0.3	0	0	0	0	0.6	0.9	5.8
	(b)	23-1	25-0	14-0	9-0	4-0					8-0	4-0	15-0
Tavistock													
Screen	(a)	9.6	8.5	5.9	2.4	0.6	0	0	0	0	1.1	4.6	7.6
	(b)	19-3	21-1	11-1	7-0	4-0					8-0	19-0	20-0
Ground	(a)	15.2	14.5	13.7	11.2	5.6	1.6	0.3	0.3	2.2	6.5	11.6	14.8
	(b)	23-7	24-6	25-8	19-2	12.1	6-0	2-0	1-0	6-0	12-1	21-3	24-4
< 30°F.	(a)	5.2	4.5	3.5	0.5	0.2	0	0	0	0	0.3	1.9	4.6
	(b)	17-0	17-0	9-0	2-0	2-0					2-0	13-0	16-0

TABLE A - continued

Monthly Means of Occasions of Screen and Ground Frosts and Screen Temperatures less than 30°F. with Range (1927 - 46)

(a) Occasions (b) Range

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Ellbridge													
Screen	(a)	9.7	8.3	7.5	2.4	0.9	0	0	0	0.1	0.4	3.8	8.0
	(b)	20-2	21-3	14-2	8-0	4-0				1-0	3-0	10-0	21-0
Ground	(a)	16.1	14.6	14.8	16.5	3.5	0	0	0	0	2.2	8.5	12.9
	(b)	23-10	25-9	23-7	13-0	12-0					7-0	20-0	25-2
< 30°F.	(a)	6.3	4.7	3.9	0.5	0.2	0	0	0	0	0.1	1.4	3.7
	(b)	14-0	16-0	9-0	2-0	2-0					2-0	5-0	15-0
Falmouth													
Screen	(a)	3.2	3.3	1.6	0	0	0	0	0	0	0	0.5	2.6
	(b)	15-0	16-0	6-0								3-0	10-0
Ground	(a)	9.3	7.2	7.1	3.3	1.0	0	0	0	0	0.8	4.8	6.7
	(b)	22-2	19-2	15-0	12-0	5-0					4-0	9-0	13-0
< 30°F.	(a)	1.3	1.1	0.5	0	0	0	0	0	0	0	0	1.0
	(b)	6-0	6-0	3-0									6-0
Fowey													
Screen	(a)	5.3	4.0	3.8	0.4	0.1	0	0	0	0	0.1	0.7	4.2
	(b)	19-0	11-0	9-0	3-0	1-0					1-0	3-0	17-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	2.3	1.0	1.1	0	0	0	0	0	0	0	0.2	2.3
	(b)	13-0	4-0	5-0								2-0	11-0
Gulval													
Screen	(a)	4.0	3.8	2.3	0.5	0	0	0	0	0	0.1	0.4	3.5
	(b)	14-0	16-0	8-0	3-0						1-0	2-0	13-0
Ground	(a)	7.5	6.7	7.0	4.1	1.0	0	0	0	0	0.8	4.2	7.5
	(b)	15-0	12-0	14-2	14-0	9-0					4-0	10-0	19-0
< 30°F.	(a)	1.7	0.7	0.7	0	0	0	0	0	0	0.1	0.05	1.1
	(b)	7-0	3-0	4-0							1-0	1-0	6-0
Penzance													
Screen	(a)	2.1	2.7	1.3	0	0	0	0	0	0	0.1	0.2	2.2
	(b)	8-0	13-0	5-0							2-0	1-0	6-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	0.9	0.5	0.3	0	0	0	0	0	0	0	0	0.6
	(b)	5-0	6-0	3-0									4-0
Newquay													
Screen	(a)	4.5	4.7	3.4	0.7	0.1	0	0	0	0	0.1	0.8	4.4
	(b)	14-0	21-0	10-0	4-0	1-0					2-0	2-0	14-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	2.0	1.3	1.2	0	0	0	0	0	0	0	0.1	2.3
	(b)	10-0	9-0	5-0								1-0	11-0

TABLE A - continued

Monthly Means of Occasions of Screen and Ground Frosts and Screen Temperatures less than 30°F. with Range (1927-46)

(a) Occasions (b) Range

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bude													
Screen	(a)	7.0	6.7	5.8	2.2	0.5	0	0	0	0	0.4	2.5	6.5
	(b)	21-0	19-0	12-1	8-0	4-0					3-0	8-0	21-0
Ground	(a)	-	-	-	-	-	-	-	-	-	-	-	-
	(b)	-	-	-	-	-	-	-	-	-	-	-	-
< 30°F.	(a)	4.1	3.3	2.7	0.5	0.1	0	0	0	0	0.1	1.3	3.9
	(b)	15-0	14-0	7-0	3-0	1-0					1-0	8-0	17-0
Barnstaple													
Screen	(a)	9.2	7.9	8.2	3.2	0.9	0	0	0	0.1	1.3	4.0	6.6
	(b)	21-0	22-1	15-1	10-0	6-0				1-0	5-0	10-0	25-0
Ground	(a)	8.4	8.2	7.6	3.9	0.9	0	0	0	0.1	1.6	4.0	6.9
	(b)	21-2	20-1	14-1	13-0	4-0				1-0	5-0	10-0	23-0
< 30°F.	(a)	5.8	4.6	4.7	1.0	0.3	0	0	0	0	0.3	2.1	5.0
	(b)	16-0	20-0	10-1	4-0	3-0					4-0	8-0	21-0

See Table A

TABLE B

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath (20 years)												
0	0	0	5	15	50	100	100	100	100	25	5	0
1-3	5	5	0	55	45	0	0	0	0	70	35	10
4-7	25	40	50	25	5					5	35	25
8-11	30	10	15	5	0					0	25	20
12-15	5	25	30	0							0	30
16-19	20	15	0									10
20-23	10	5										5
24-27	5	0										0
28-31	0											
Portland Bill (16 years)												
0	44	38	38	94	94	100	100	100	100	93	81	25
1-3	19	19	31	6	6	0	0	0	0	7	19	44
4-7	13	31	31	0	0					0	0	12
8-11	6	6	0									19
12-15	12	0										0
16-19	6	0										
20-23	0	6										
24-27		0										
28-31												
Plymouth (Mount Batten) (16 years)												
0	13	0	0	69	94	100	100	100	100	94	38	6
1-3	31	50	38	25	6	0	0	0	0	6	50	44
4-7	25	19	31	6	0					0	12	25
8-11	6	19	25	0							0	19
12-15	19	0	6									0
16-19	6	6	0									6
20-23	0	6										0
24-27		0										
28-31												
Princetown (16 years)												
0	0	0	7	19	63	100	100	100	100	56	12	6
1-3	6	0	0	37	19	0	0	0	0	25	19	6
4-7	7	20	20	19	12					13	56	13
8-11	20	7	27	6	6					0	13	31
12-15	27	33	27	19	0					6	0	25
16-19	7	33	13	0						0		6
20-23	13	0	0									13
24-27	20	7	6									0
28-31	0	0	0									
Paignton (16 years)												
0	6	0	6	44	93	100	100	100	100	81	31	6
1-3	13	38	25	56	7	0	0	0	0	19	44	19
4-7	31	31	38	0	0					0	25	44
8-11	31	25	31								0	19
12-15	13	6	0									6
16-19	6	0										6
20-23	0											0
24-27												
28-31												
Cannington (18 and 19 years)												
0	5	0	0	50	61	100	100	100	100	58	16	11
1-3	11	22	17	28	39	0	0	0	0	37	53	0
4-7	33	28	33	17	0					5	10	37
8-11	6	6	22	5						0	21	21
12-15	17	28	28	0							0	26
16-19	17	11	0									0
20-23	6	5										0
24-27	5	0										5
28-31	0											0

TABLE B - continued

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Long Ashton (20 years)												
0	5	0	5	25	45	100	100	100	100	25	10	0
1-3	0	10	0	45	50	0	0	0	0	65	30	10
4-7	25	35	35	20	5					5	30	25
8-11	25	0	25	10	0					5	25	30
12-15	10	30	20	0						0	5	20
16-19	15	15	15								0	5
20-23	10	5	0									5
24-27	10	5										5
28-31	0	0										0
Holton Heath (20 years)												
0	0	0	0	5	45	100	100	100	95	15	5	5
1-3	5	5	5	60	40	0	0	0	5	65	30	10
4-7	15	15	20	15	15				0	20	30	10
8-11	30	35	40	20	0					0	30	30
12-15	10	25	15	0							5	40
16-19	15	15	15								0	0
20-23	20	5	5									5
24-27	5	0	0									0
28-31	0											
Weymouth (20 years)												
0	5	5	5	70	90	100	100	100	100	90	25	5
1-3	25	30	40	30	10	0	0	0	0	10	60	25
4-7	25	35	30	0	0					0	15	25
8-11	10	10	25								0	35
12-15	20	15	0									5
16-19	5	0										5
20-23	10	5										0
24-27	0	0										
28-31												
Cullompton (20 years)												
0	0	0	0	10	50	95	100	100	100	35	0	5
1-3	10	0	10	40	35	5	0	0	0	50	25	5
4-7	15	40	25	35	15	0				15	30	15
8-11	25	10	30	15	0					0	35	30
12-15	15	30	20	0							10	30
16-19	10	15	15								0	10
20-23	20	5	0									5
24-27	5	0										0
28-31	0											
Shaftesbury (20 years)												
0	0	0	10	10	70	100	100	100	100	75	15	5
1-3	10	15	10	50	20	0	0	0	0	25	35	5
4-7	25	10	20	25	10					0	30	25
8-11	20	20	15	15	0						20	10
12-15	5	20	35	0							0	35
16-19	10	15	5									15
20-23	15	15	5									5
24-27	10	5	0									0
28-31	5	0										
Ilfracombe (20 years)												
0	45	35	45	100	100	100	100	100	100	100	90	30
1-3	15	35	45	0	0	0	0	0	0	0	10	35
4-7	15	20	10								0	25
8-11	20	5	0									5
12-15	0	5										5
16-19	5	0										0
20-23	0											
24-27												
28-31												

TABLE B - continued

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Killerton (18-20 years)												
0	0	0	0	20	40	100	100	100	100	39	6	6
1-3	10	10	10	40	55	0	0	0	0	50	22	0
4-7	20	30	35	30	5					11	44	22
8-11	30	10	30	10	0					0	28	33
12-15	15	30	10	0							0	33
16-19	10	15	15									0
20-23	10	0	0									6
24-27	5	5										0
28-31	0	0										
Newton Abbot (20 years)												
0	0	0	5	50	80	100	100	100	100	90	25	5
1-3	30	35	40	35	20	0	0	0	0	10	55	25
4-7	30	15	15	15	0					0	20	15
8-11	10	25	30	0							0	30
12-15	10	15	10									20
16-19	10	5	0									5
20-23	10	5										0
24-27	0	0										
28-31												
Plymouth Hoe (20 years)												
0	10	10	15	75	90	100	100	100	100	95	40	5
1-3	40	40	35	25	10	0	0	0	0	5	55	40
4-7	25	20	45	0	0					0	5	30
8-11	5	20	5								0	15
12-15	15	5	0									10
16-19	5	5										0
20-23	0	0										
24-27												
28-31												
Sidmouth (20 years)												
0	5	0	5	60	80	100	100	100	100	80	20	5
1-3	15	25	30	40	20	0	0	0	0	15	55	21
4-7	35	25	35	0	0					5	25	37
8-11	10	25	30							0	0	21
12-15	15	20	0									11
16-19	20	0										5
20-23	0	5										0
24-27		0										
28-31												
Tavistock (20 years)												
0	0	0	0	20	65	100	100	100	100	45	15	5
1-3	5	25	25	55	30	0	0	0	0	45	35	5
4-7	40	20	45	25	5					5	30	40
8-11	25	25	25	0	0					5	15	40
12-15	10	15	5							0	5	5
16-19	20	10	0								0	0
20-23	0	5										5
24-27		0										0
28-31												
Teignmouth (20 years)												
0	20	15	5	75	100	100	100	100	100	95	40	10
1-3	30	40	35	25	0	0	0	0	0	5	55	25
4-7	10	20	50	0						0	5	40
8-11	20	15	10								0	20
12-15	15	5	0									0
16-19	5	5										5
20-23	0	0										0
24-27												
28-31												

TABLE B - continued

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Torquay (20 years)												
0	5	5	5	75	85	100	100	100	100	95	40	10
1-3	30	40	30	20	15	0	0	0	0	5	45	25
4-7	25	30	55	5	0					0	15	35
8-11	20	15	10	0							0	20
12-15	10	5	0									10
16-19	10	5										0
20-23	0	0										
24-27												
28-31												
Exmouth (20 years)												
0	5	5	10	40	95	100	100	100	100	85	25	5
1-3	25	20	20	55	5	0	0	0	0	10	40	20
4-7	25	20	40	5	0					5	35	30
8-11	10	30	25	0						0	0	30
12-15	15	20	5									10
16-19	10	0	0									5
20-23	10	5										0
24-27	0	0										
28-31												
Barnstaple (20 years)												
0	5	0	0	25	60	100	100	100	95	55	20	20
1-3	10	35	10	40	35	0	0	0	5	30	15	10
4-7	40	20	30	25	5				0	15	55	40
8-11	5	20	40	10	0					0	10	20
12-15	20	15	20	0							0	5
16-19	10	5	0									0
20-23	10	5										0
24-27	0	0										5
28-31												0
Falmouth (20 years)												
0	35	30	35	100	100	100	100	100	100	100	70	40
1-3	30	35	50	0	0	0	0	0	0	0	30	25
4-7	15	25	15								0	30
8-11	5	5	0									5
12-15	15	0										0
16-19	0	5										
20-23		0										
24-27												
28-31												
Gulval (20 years)												
0	15	25	25	70	100	100	100	100	100	95	65	37
1-3	50	35	45	30	0	0	0	0	0	5	35	21
4-7	10	30	25	0						0	0	37
8-11	15	5	5									0
12-15	10	0	0									5
16-19	0	5										0
20-23		0										
24-27												
28-31												
Newquay (20 years)												
0	25	15	10	65	95	100	100	100	100	95	50	15
1-3	30	40	45	30	5	0	0	0	0	5	50	35
4-7	20	10	35	5	0					0	0	25
8-11	10	30	10	0								20
12-15	15	0	0									5
16-19	0	0										0
20-23		5										
24-27		0										
28-31												

TABLE B - continued

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bude (20 years)												
0	5	5	0	30	70	100	100	100	100	80	25	10
1-3	35	35	25	50	25	0	0	0	0	20	50	15
4-7	20	15	45	15	5					0	20	40
8-11	10	30	25	5	0						5	25
12-15	25	5	5	0							0	5
16-19	0	10	0									0
20-23	5	0										5
24-27	0											0
28-31												
Penzance (20 years)												
0	50	40	50	100	100	100	100	100	100	95	85	45
1-3	30	40	35	0	0	0	0	0	0	5	15	35
4-7	10	10	15							0	0	15
8-11	10	5	0									5
12-15	0	5										0
16-19		0										
20-23												
24-27												
28-31												
Seaton (15 years)												
0	6	0	0	33	67	100	100	100	100	47	13	13
1-3	7	20	20	40	27	0	0	0	0	53	20	0
4-7	20	27	47	27	6					0	60	27
8-11	20	27	13	0	0						7	34
12-15	7	13	20								0	13
16-19	40	7	0									13
20-23	0	6										0
24-27		0										
28-31												
Fowey (19 years)												
0	22	17	11	72	100	100	100	100	100	95	56	28
1-3	33	39	39	28	0	0	0	0	0	5	44	28
4-7	22	22	39	0						0	0	17
8-11	6	22	11									22
12-15	0	0	0									0
16-19	17											5
20-23	0											0
24-27												
28-31												
Lizard Pt. (15 years)												
0	50	36	57	86	93	100	100	100	100	100	100	53
1-3	29	36	36	14	7	0	0	0	0	0	0	20
4-7	0	21	7	0	0							27
8-11	21	7	0									0
12-15	0	0										
16-19												
20-23												
24-27												
28-31												
Redruth (13 years)												
0	31	15	23	54	92	100	100	100	100	92	67	33
1-3	38	31	31	46	8	0	0	0	0	8	33	25
4-7	23	31	39	0	0					0	0	17
8-11	0	15	7									17
12-15	0	8	0									8
16-19	8	0										0
20-23	0											
24-27												
28-31												

TABLE B - continued

Percentage Frequency of Screen Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Ellbridge (19 years)												
0	5	0	0	22	50	100	100	100	95	72	22	5
1-3	6	17	17	50	44	0	0	0	5	28	22	5
4-7	33	33	44	22	6				0	0	45	37
8-11	28	22	17	6	0						11	32
12-15	6	22	22	0							0	16
16-19	17	0	0									0
20-23	5	6										5
24-27	0	0										0
28-31												

TABLE C

Percentage Frequency of Ground Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cannington (17 years)												
0	0	0	0	29	12	94	100	100	71	12	0	0
1-3	0	0	0	23	35	6	0	0	29	35	6	6
4-7	6	6	6	18	41	0			0	41	24	6
8-11	23	35	6	18	12					12	35	23
12-15	24	24	29	12	0					0	29	35
16-19	29	18	47	0							6	24
20-23	12	17	12								0	6
24-27	6	0	0									0
28-31	0											
Long Ashton (20 years)												
0	0	0	0	0	15	85	100	100	55	0	0	0
1-3	0	0	0	5	35	15	0	0	40	40	0	0
4-7	5	5	10	35	40	0			5	40	25	5
8-11	5	15	10	35	5				0	15	30	30
12-15	40	25	40	15	5					5	20	15
16-19	20	40	15	5	0					0	20	25
20-23	15	10	25	5							5	15
24-27	15	5	0	0							0	10
28-31	0	0										0
Holton Heath (20 years)												
0	0	0	0	0	15	85	100	95	56	0	0	0
1-3	0	0	0	15	35	15	0	5	44	21	0	5
4-7	0	5	0	35	30	0		0	0	58	11	5
8-11	25	15	20	5	20					16	42	11
12-15	20	20	30	25	0					5	42	26
16-19	25	35	30	10						0	5	26
20-23	10	20	5	10							0	16
24-27	20	5	15	0								11
28-31	0	0	0									0
Cullompton (20 years)												
0	0	0	0	0	10	90	100	95	40	5	0	0
1-3	5	0	0	10	30	10	0	5	50	15	0	0
4-7	0	5	0	20	45	0		0	5	25	6	0
8-11	5	5	15	30	5				5	45	22	17
12-15	30	15	25	30	10				0	5	39	22
16-19	35	45	20	5	0					5	22	6
20-23	10	25	25	5						0	11	39
24-27	10	5	15	0							0	11
28-31	5	0	0									5
Ilfracombe (20 years)												
0	20	30	10	80	90	100	100	100	100	95	70	20
1-3	30	25	45	20	10	0	0	0	0	5	30	35
4-7	20	30	35	0	0					0	0	25
8-11	20	0	5									15
12-15	5	15	5									0
16-19	5	0	0									5
20-23	0											0
24-27												
28-31												
Killerton (19 years)												
0	0	0	0	0	17	53	94	89	50	12	0	0
1-3	5	0	5	5	11	18	6	11	28	35	11	5
4-7	5	0	0	28	39	23	0	0	22	35	11	6
8-11	15	16	11	17	17	6			0	6	22	22
12-15	15	21	26	39	11	0				6	34	17
16-19	20	26	42	6	5					0	22	22
20-23	15	26	5	5	0					6	0	17
24-27	20	11	11	0						0	0	6
28-31	5	0	0									5

TABLE C - continued

Percentage Frequency of Ground Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Newton Abbot (17 years)												
0	6	0	0	0	36	86	100	100	93	20	0	12
1-3	6	0	0	20	36	14	0	0	0	47	20	0
4-7	6	7	13	47	7	0			7	27	33	12
8-11	25	33	20	7	21				0	0	34	6
12-15	19	27	40	26	0					6	0	12
16-19	13	13	20	0						0	0	17
20-23	13	13	0								13	12
24-27	12	7	0								0	17
28-31	0	0	7									12
Paignton (13 years)												
0	0	0	0	8	50	100	100	100	100	15	0	0
1-3	0	0	0	38	42	0	0	0	0	62	15	15
4-7	15	15	23	31	8					23	46	8
8-11	31	46	39	23	0					0	16	23
12-15	31	31	23	0							23	46
16-19	23	8	15								0	0
20-23	0	0	0									8
24-27												0
28-31												
Plymouth Hoe (20 years)												
0	0	5	0	15	70	100	100	100	95	60	10	5
1-3	20	10	10	50	25	0	0	0	5	30	32	21
4-7	35	35	40	25	5				0	10	37	42
8-11	10	15	35	5	0					0	21	6
12-15	15	30	5	5							0	21
16-19	15	5	5	0								5
20-23	5	0	5									0
24-27	0		0									
28-31												
Plymouth (Mount Batten) (18 years)												
0	5	0	0	22	44	100	100	100	83	33	17	6
1-3	22	17	11	34	39	0	0	0	17	61	39	33
4-7	28	28	28	22	6				0	6	17	28
8-11	11	33	39	22	11					0	22	22
12-15	28	17	11	0	0						5	11
16-19	6	0	6								0	0
20-23	0	5	5									
24-27		0	0									
28-31												
Princetown (17 years)												
0	0	0	0	6	50	100	100	100	94	44	6	0
1-3	6	0	6	35	31	0	0	0	6	25	12	6
4-7	12	23	6	41	13				0	25	47	13
8-11	13	18	44	6	6					0	23	25
12-15	25	12	25	6	0					0	6	25
16-19	6	23	19	6						6	0	13
20-23	13	18	0	0						0	0	6
24-27	25	6									6	6
28-31	0	0									0	6
Sidmouth (19 years)												
0	0	0	0	19	69	100	100	100	100	39	12	6
1-3	0	5	11	50	25	0	0	0	0	56	29	12
4-7	37	21	22	25	6					5	53	18
8-11	16	21	33	0	0					0	6	35
12-15	10	48	28	6							0	17
16-19	16	0	0	0								6
20-23	16	5	6									6
24-27	5	0	0									0
28-31	0											

TABLE C - continued

Percentage Frequency of Ground Frosts (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tavistock (20 years)												
0	0	0	0	0	5	45	80	75	20	5	0	0
1-3	0	0	0	10	26	45	20	25	60	15	5	0
4-7	5	5	5	25	48	10	0	0	20	60	10	5
8-11	20	30	35	20	16	0			0	10	30	10
12-15	35	20	20	20	5					10	45	45
16-19	10	30	30	20	0					0	5	25
20-23	30	10	5	5							5	10
24-27	0	5	5	0							0	5
28-31		0	0									0
Teignmouth (15 years)												
0	0	0	7	54	87	100	100	100	100	93	23	7
1-3	13	13	14	33	13	0	0	0	0	7	69	33
4-7	20	47	36	13	0					0	8	33
8-11	40	20	36	0							0	20
12-15	7	13	7									7
16-19	20	0	0									0
20-23	0	7										
24-27		0										
28-31												
Torquay (20 years)												
0	0	0	0	30	60	100	100	100	100	60	10	0
1-3	5	5	20	55	35	0	0	0	0	40	30	5
4-7	20	45	20	10	5					0	45	10
8-11	35	30	45	5	0						15	45
12-15	35	10	10	0							0	20
16-19	0	10	5									15
20-23	5	0	0									5
24-27	0											0
28-31												
Falmouth (19 years)												
0	0	0	5	45	45	100	100	100	100	58	5	5
1-3	16	26	5	20	45	0	0	0	0	37	32	16
4-7	37	32	48	25	10					5	47	37
8-11	21	26	26	5	0					0	16	26
12-15	16	5	16	5							0	16
16-19	5	11	0	0.								0
20-23	5	0										
24-27	0											
28-31												
Gulval (20 years)												
0	5	5	0	20	50	100	100	100	100	55	5	5
1-3	10	20	15	35	45	0	0	0	0	40	45	20
4-7	45	40	40	25	0					5	30	35
8-11	20	25	35	15	5					0	20	15
12-15	20	5	10	5	0						0	20
16-19	0	5	0	0								5
20-23		0										0
24-27												
28-31												
Ellbridge (19 years)												
0	0	0	0	10	30	100	100	100	100	45	9	0
1-3	0	0	0	0	30	0	0	0	0	28	9	9
4-7	0	0	12	60	30					27	28	18
8-11	30	30	22	20	0					0	27	0
12-15	0	30	22	10	10						18	37
16-19	40	20	22	0	0						0	27
20-23	30	10	22								9	0
24-27	0	10	0								0	9
28-31		0										0

TABLE D

Percentage Frequency of Screen Temperatures less than 30°F. (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath (20 years)												
0	0	5	5	60	90	100	100	100	100	75	15	15
1-3	40	35	45	40	10	0	0	0	0	20	60	10
4-7	20	20	30	0	0					5	25	35
8-11	10	30	20							0	0	30
12-15	15	5	0									10
16-19	10	5										0
20-23	0	0										
24-27	5											
28-31	0											
Cannington (19 years)												
0	21	16	11	68	100	100	100	100	100	79	53	10
1-3	21	32	42	32	0	0	0	0	0	21	31	32
4-7	16	26	37	0						0	16	37
8-11	21	11	10								0	16
12-15	16	10	0									0
16-19	0	0										5
20-23	5	5										0
24-27	0	0										
28-31												
Long Ashton (20-years)												
0	10	25	10	70	85	100	100	100	100	80	35	10
1-3	25	25	35	20	10	0	0	0	0	15	45	20
4-7	20	15	40	10	5					5	15	40
8-11	10	20	15	0	0					0	5	20
12-15	15	5	0								0	0
16-19	15	10										10
20-23	5	0										0
24-27	0											
28-31												
Holton Heath (20 years)												
0	5	5	5	45	85	100	100	100	100	75	15	10
1-3	20	25	25	45	15	0	0	0	0	20	55	15
4-7	25	30	40	10	0					5	30	40
8-11	15	20	25	0						0	0	30
12-15	20	15	5									5
16-19	10	5	0									0
20-23	5	0										
24-27	0											
28-31												
Weymouth (20 years)												
0	25	35	35	90	100	100	100	100	100	100	80	25
1-3	30	30	45	10	0	0	0	0	0	0	20	40
4-7	20	25	15	0							0	25
8-11	20	5	5									10
12-15	0	5	0									0
16-19	5	0										
20-23	0											
24-27												
28-31												

TABLE D - continued

Percentage Frequency of Screen Temperatures less than 30°F. (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cullompton (20 years)												
0	5	10	5	50	90	100	100	100	100	65	20	10
1-3	15	35	20	40	10	0	0	0	0	30	55	15
4-7	35	20	45	10	0					5	20	35
8-11	15	20	20	0						0	5	30
12-15	20	10	10								0	5
16-19	10	0	0									5
20-23	0	5										0
24-27		0										
28-31												
Shaftesbury (20 years)												
0	15	10	20	80	100	100	100	100	100	95	50	5
1-3	30	25	25	20	0	0	0	0	0	5	40	35
4-7	15	25	35	0						0	10	15
8-11	5	25	20								0	35
12-15	15	5	0									10
16-19	10	5										0
20-23	10	0										
24-27	0	5										
28-31		0										
Ilfracombe (20 years)												
0	70	55	75	100	100	100	100	100	100	100	100	60
1-3	15	35	25	0	0	0	0	0	0	0	0	40
4-7	10	5	0									0
8-11	0	5										
12-15	5	0										
16-19	0											
20-23												
24-27												
28-31												
Killerton (20 years)												
0	5	15	5	50	75	100	100	100	100	80	15	15
1-3	25	40	15	35	25	0	0	0	0	15	60	25
4-7	30	20	60	10	0					5	20	40
8-11	15	10	15	5						0	0	15
12-15	15	10	5	0							5	0
16-19	10	0	0								0	5
20-23	0	5										0
24-27		0										
28-31												
Newton Abbot (20 years)												
0	25	25	25	85	90	100	100	100	100	100	70	20
1-3	40	30	45	15	10	0	0	0	0	0	30	25
4-7	10	30	25	0	0						0	50
8-11	5	10	5									0
12-15	15	0	0									5
16-19	5	0										0
20-23	0	5										
24-27		0										
28-31												

TABLE D - continued

Percentage Frequency of Screen Temperatures less than 30°F. (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Plymouth Hoe (20 years)												
0	40	40	55	100	100	100	100	100	100	100	80	45
1-3	25	30	40	0	0	0	0	0	0	0	20	30
4-7	25	20	5								0	20
8-11	10	10	0									5
12-15	0	0										0
16-19												
20-23												
24-27												
28-31												
Princetown (19 years)												
0	0	6	5	58	84	100	100	100	100	79	53	5
1-3	33	22	39	26	11	0	0	0	0	16	42	32
4-7	28	17	22	11	5					0	5	32
8-11	6	22	28	5	0					5	0	21
12-15	11	11	6	0						0		10
16-19	11	11	0									0
20-23	11	6										
24-27	0	5										
28-31		0										
Sidmouth (20 years)												
0	20	35	30	95	100	100	100	100	100	95	60	20
1-3	40	25	35	5	0	0	0	0	0	5	40	40
4-7	20	30	35	0						0	0	30
8-11	10	5	0									10
12-15	5	5										0
16-19	5	0										
20-23	0											
24-27												
28-31												
Tavistock (20 years)												
0	5	5	20	65	90	100	100	100	100	80	40	15
1-3	45	45	40	35	10	0	0	0	0	20	50	40
4-7	20	30	25	0	0					0	5	25
8-11	20	10	15								0	15
12-15	5	5	0								5	0
16-19	5	5									0	5
20-23	0	0										0
24-27												
28-31												
Teignmouth (20 years)												
0	30	45	45	100	100	100	100	100	100	100	80	30
1-3	35	40	45	0	0	0	0	0	0	0	20	50
4-7	25	10	10								0	15
8-11	0	0	0									5
12-15	10	5										0
16-19	0	0										
20-23												
24-27												
28-31												

TABLE D - continued

Percentage Frequency of Screen Temperatures less than 30°F. (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Torquay (20 years)												
0	35	40	40	100	100	100	100	100	100	100	80	45
1-3	35	40	50	0	0	0	0	0	0	0	20	20
4-7	20	15	10								0	30
8-11	0	5	0									5
12-15	10	0										0
16-19	0											
20-23												
24-27												
28-31												
Exmouth (20 years)												
0	35	25	35	90	100	100	100	100	100	100	60	10
1-3	20	35	30	10	0	0	0	0	0	0	35	40
4-7	20	30	35	0							5	35
8-11	15	5	0								0	10
12-15	5	0										5
16-19	5	0										0
20-23	0	5										
24-27		0										
28-31												
Barnstaple (20 years)												
0	5	20	0	60	90	100	100	100	100	85	25	15
1-3	45	40	40	35	10	0	0	0	0	10	55	30
4-7	10	15	40	5	0					5	15	40
8-11	25	15	20	0						0	5	10
12-15	10	5	0								0	0
16-19	5	0										0
20-23	0	5										5
24-27		0										0
28-31												
Falmouth (20 years)												
0	65	55	75	100	100	100	100	100	100	100	100	65
1-3	15	40	25	0	0	0	0	0	0	0	0	25
4-7	20	5	0									10
8-11	0	0										0
12-15												
16-19												
20-23												
24-27												
28-31												
Fowey (19 years)												
0	44	55	61	100	100	100	100	100	100	100	83	50
1-3	28	39	22	0	0	0	0	0	0	0	17	17
4-7	17	6	17								0	28
8-11	6	0	0									5
12-15	5											0
16-19	0											
20-23												
24-27												
28-31												

TABLE D - continued

Percentage Frequency of Screen Temperatures less than 30°F. (1927-46)

Occasions	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Gulval (20 years)												
0	55	55	60	100	100	100	100	100	100	95	95	60
1-3	20	45	35	0	0	0	0	0	0	5	5	30
4-7	25	0	5							0	0	10
8-11	0		0									0
12-15												
16-19												
20-23												
24-27												
28-31												
Newquay (20 years)												
0	55	55	60	100	100	100	100	100	100	100	90	40
1-3	20	35	25	0	0	0	0	0	0	0	10	40
4-7	20	5	15								0	15
8-11	5	5	0									5
12-15	0	0										0
16-19												
20-23												
24-27												
28-31												
Bude (20 years)												
0	25	40	30	70	95	100	100	100	100	95	40	25
1-3	30	30	25	30	5	0	0	0	0	5	50	35
4-7	20	15	45	0	0					0	5	20
8-11	20	5	0								5	15
12-15	5	10									0	0
16-19	0	0										5
20-23												0
24-27												
28-31												
Ellbridge (19 years)												
0	11	11	5	58	84	100	100	100	100	89	37	21
1-3	37	47	48	42	16	0	0	0	0	11	58	37
4-7	21	21	42	0	0					0	5	21
8-11	21	11	5								0	16
12-15	10	5	0									5
16-19	0	5										0
20-23		0										
24-27												
28-31												
Penzance (20 years)												
0	70	80	85	100	100	100	100	100	100	100	100	80
1-3	25	15	15	0	0	0	0	0	0	0	0	15
4-7	5	5	0									5
8-11	0	0										0
12-15												
16-19												
20-23												
24-27												
28-31												

TABLE E

Percentage Frequency of Absolute Minimum Screen Temperatures (1927-46)

°F	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bath (20 years)												
< 20°	25	15	0							0	0	10
20°-24°	30	40	50	0	0					5	30	50
25°-29°	40	40	45	45	10					20	55	25
30°-32°	0	5	0	40	40	0	0	0	0	50	10	15
> 32°	5	0	5	15	50	100	100	100	100	25	5	0
Long Ashton (20 years)												
< 20°	25	10	20							0	0	10
20°-24°	20	45	15	0	0					5	30	40
25°-29°	45	25	55	35	15					20	40	40
30°-32°	5	20	5	40	40	0	0	0	0	50	20	5
> 32°	5	0	5	25	45	100	100	100	100	25	10	5
Cannington (18 years)												
< 20°	12	12	0	0						0	0	0
20°-24°	35	23	29	6	0					6	28	59
25°-29°	29	41	59	24	6					12	28	29
30°-32°	18	18	12	23	29	0	0	0	0	23	27	12
> 32°	6	6	0	47	65	100	100	100	100	59	17	0
Holton Heath (19 years)												
< 20°	25	15	5	0							0	5
20°-24°	45	35	60	5	0					0	26	48
25°-29°	25	45	30	53	20					37	58	37
30°-32°	5	5	5	37	35	0	0	0	0	47	16	5
> 32°	0	0	0	5	45	100	100	100	100	16	0	5
Portland Bill (20 years)												
< 20°	0	0	0									0
20°-24°	10	15	15								0	5
25°-29°	15	25	25								5	20
30°-32°	25	30	30	0	0	0	0	0	0	0	10	45
> 32°	50	30	30	100	100	100	100	100	100	100	85	30
Shaftesbury (20 years)												
< 20°	25	15	15									20
20°-24°	15	35	20	0	0					0	0	30
25°-29°	45	40	40	25	5					5	50	45
30°-32°	15	10	15	65	15	0	0	0	0	25	35	0
> 32°	0	0	10	10	80	100	100	100	100	70	15	5
Cullompton (20 years)												
< 20°	20	20	5							0	0	5
20°-24°	45	40	60	0	0					5	45	70
25°-29°	30	30	30	50	15	0				30	35	15
30°-32°	5	10	5	35	35	5	0	0	0	30	20	5
> 32°	0	0	0	15	50	95	100	100	100	35	0	5
Killerton (19 years)												
< 20°	10	17	0							0	0	0
20°-24°	45	22	42	0	0				0	5	32	53
25°-29°	45	44	53	53	25				5	11	53	37
30°-32°	0	17	5	31	35	0	0	0	0	47	10	5
> 32°	0	0	0	16	40	100	100	100	95	37	5	5

TABLE E - continued

Percentage Frequency of Absolute Minimum Screen Temperatures (1927-46)

°F.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Ilfracombe (20 years)												
< 20°	5	0										
20°-24°	0	5	0									0
25°-29°	25	40	25								0	40
30°-32°	25	20	35	0	0	0	0	0	0	0	10	30
> 32°	45	35	40	100	100	100	100	100	100	100	90	30
Newton Abbot (20 years)												
< 20°	15	10	0									5
20°-24°	15	25	10	0	0						0	20
25°-29°	40	40	65	15	10					0	35	55
30°-32°	30	25	20	35	15	0	0	0	0	5	40	15
> 32°	0	0	5	50	75	100	100	100	100	95	25	5
Paignton (13 years)												
< 20°	8	0	0									0
20°-24°	8	8	8	0						0	0	25
25°-29°	61	77	61	15	0					8	33	59
30°-32°	15	15	23	31	8	0	0	0	0	17	25	8
> 32°	8	0	8	54	92	100	100	100	100	75	42	8
Plymouth Hoe (20 years)												
< 20°	5	0	0								0	0
20°-24°	15	15	15								5	20
25°-29°	45	45	35	0	0					0	15	45
30°-32°	25	30	35	25	5	0	0	0	0	5	40	30
> 32°	10	10	15	75	95	100	100	100	100	95	40	5
Plymouth (Mount Batten) (20 years)												
< 20°	10	0	0									0
20°-24°	10	10	5								0	15
25°-29°	35	35	65	0	0					0	20	45
30°-32°	35	50	25	25	5	0	0	0	0	5	35	35
>32°	10	5	5	75	95	100	100	100	100	95	45	5
Princetown (19 years)												
< 20°	29	18	6	0							0	10
20°-24°	12	5	31	5	0					0	6	32
25°-29°	59	46	50	39	12					11	39	53
30°-32°	0	6	7	39	23	0	0	0	0	22	44	0
> 32°	0	0	6	17	65	100	100	100	100	67	11	5
Sidmouth (19 years)												
< 20°	10	5	0									
20°-24°	20	30	16								0	0
25°-29°	50	30	53	0	0					0	33	60
30°-32°	15	35	26	47	21	0	0	0	0	10	50	10
> 32°	5	0	5	53	79	100	100	100	100	90	17	10
Tavistock (19 years)												
< 20°	15	10	11								0	0
20°-24°	20	32	21	0	0					0	15	40
25°-29°	60	53	47	35	11					11	50	35
30°-32°	5	5	21	45	28	0	0	0	0	28	20	10
> 32°	0	0	0	20	61	100	100	100	100	61	15	5

TABLE E - continued

Percentage Frequency of Absolute Minimum Screen Temperatures (1927-46)

°F.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Teignmouth (20 years)												
< 20°	11	0										0
20°-24°	16	21	0								0	15
25°-29°	42	37	55	0						0	20	55
30°-32°	10	32	40	20	0	0	0	0	0	5	35	20
> 32°	21	10	5	80	100	100	100	100	100	95	45	10
Torquay (20 years)												
< 20°	5	0	0									0
20°-24°	10	15	5								0	15
25°-29°	50	45	50	0	0					0	20	40
30°-32°	30	35	40	20	15	0	0	0	0	5	40	35
> 32°	5	5	5	80	85	100	100	100	100	95	40	10
Falmouth (20 years)												
< 20°	0	0	0									0
20°-24°	10	10	10								0	10
25°-29°	25	35	15		0						30	25
30°-32°	30	25	40	0	5	0	0	0	0	0	70	40
> 32	35	30	35	100	95	100	100	100	100	100		
Fowey (18 years)												
< 20°	5	0	0								0	0
20°-24°	17	16	6								0	18
25°-29°	28	28	33	0	0					0	19	25
30°-32°	28	39	50	29	6	0	0	0	0	11	25	24
> 32°	22	17	11	71	94	100	100	100	100	89	56	23
Gulval (20 years)												
< 20°	0											0
20°-24°	10	0	0									7
25°-29°	25	50	45	0								20
30°-32°	50	25	30	30	0	0	0	0	0	0	0	20
> 32°	15	25	25	70	100	100	100	100	100	100	100	53
Lizard Pt. (15 years)												
< 20°	0	0										0
20°-24°	14	7										7
25°-29°	14	28	0	0								20
30°-32°	22	29	43	14	0	0	0	0	0	0	0	20
> 32°	50	36	57	86	100	100	100	100	100	100	100	53
Newquay (20 years)												
< 20°	5	0	0									0
20°-24°	15	25	10								0	0
25°-29°	30	25	30	0	0						5	10
30°-32°	25	35	50	35	5	0	0	0	0	0	45	25
> 32°	25	15	10	65	95	100	100	100	100	95	45	15
Redruth (13 years)												
< 20°	0	0	0									0
20°-24°	15	8	8									17
25°-29°	0	46	38	0	0						0	17
30°-32°	54	31	31	46	8	0	0	0	0	0	33	33
> 32°	31	15	23	54	92	100	100	100	100	100	67	33

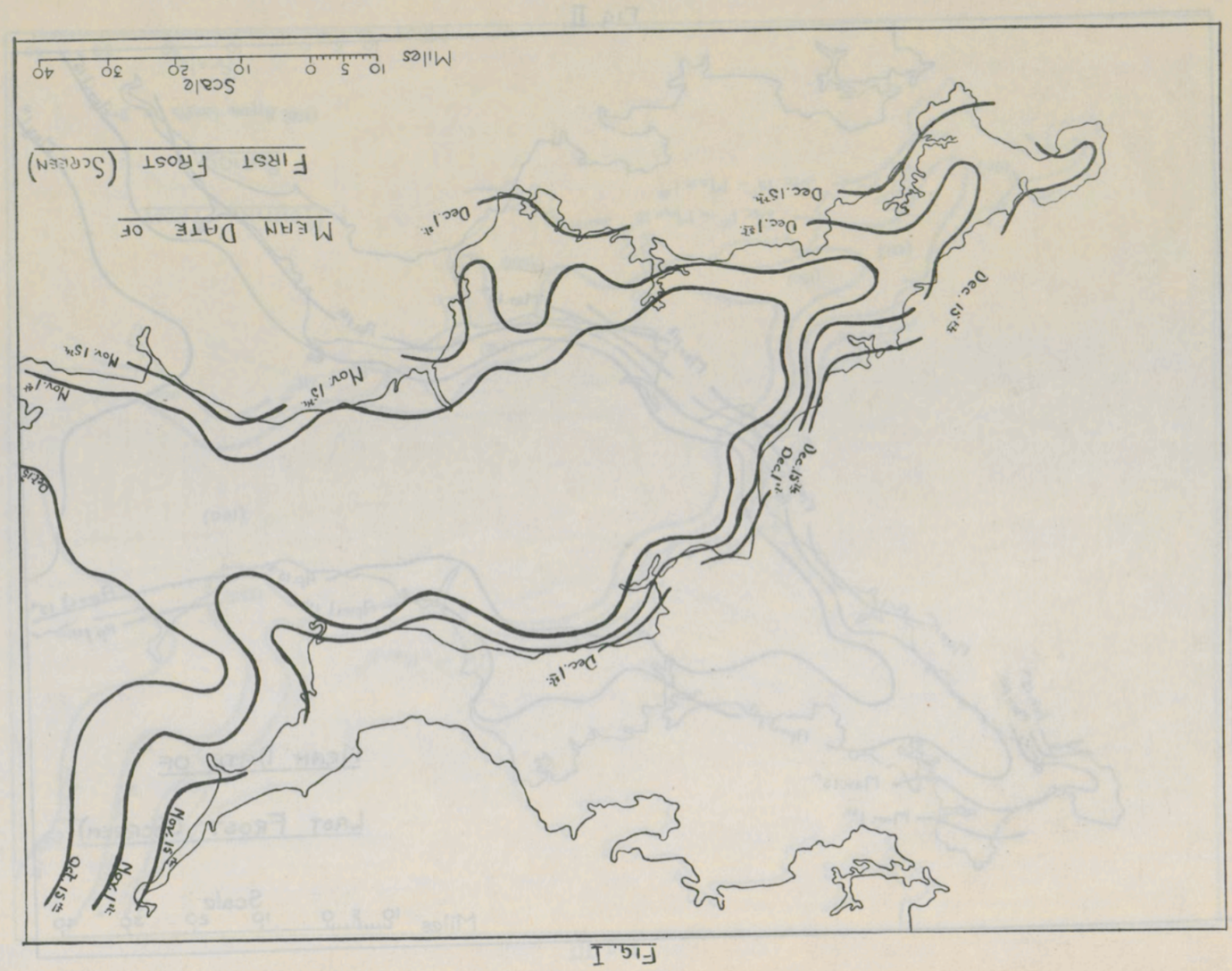

Miles
10 5 0 10 20 30 40
Scale
First Frost (Screen)
Mean Date of
Oct.15th
Nov.1st
Nov.15th
Dec.1st
Dec.15th

Fig. 1

FIG. II

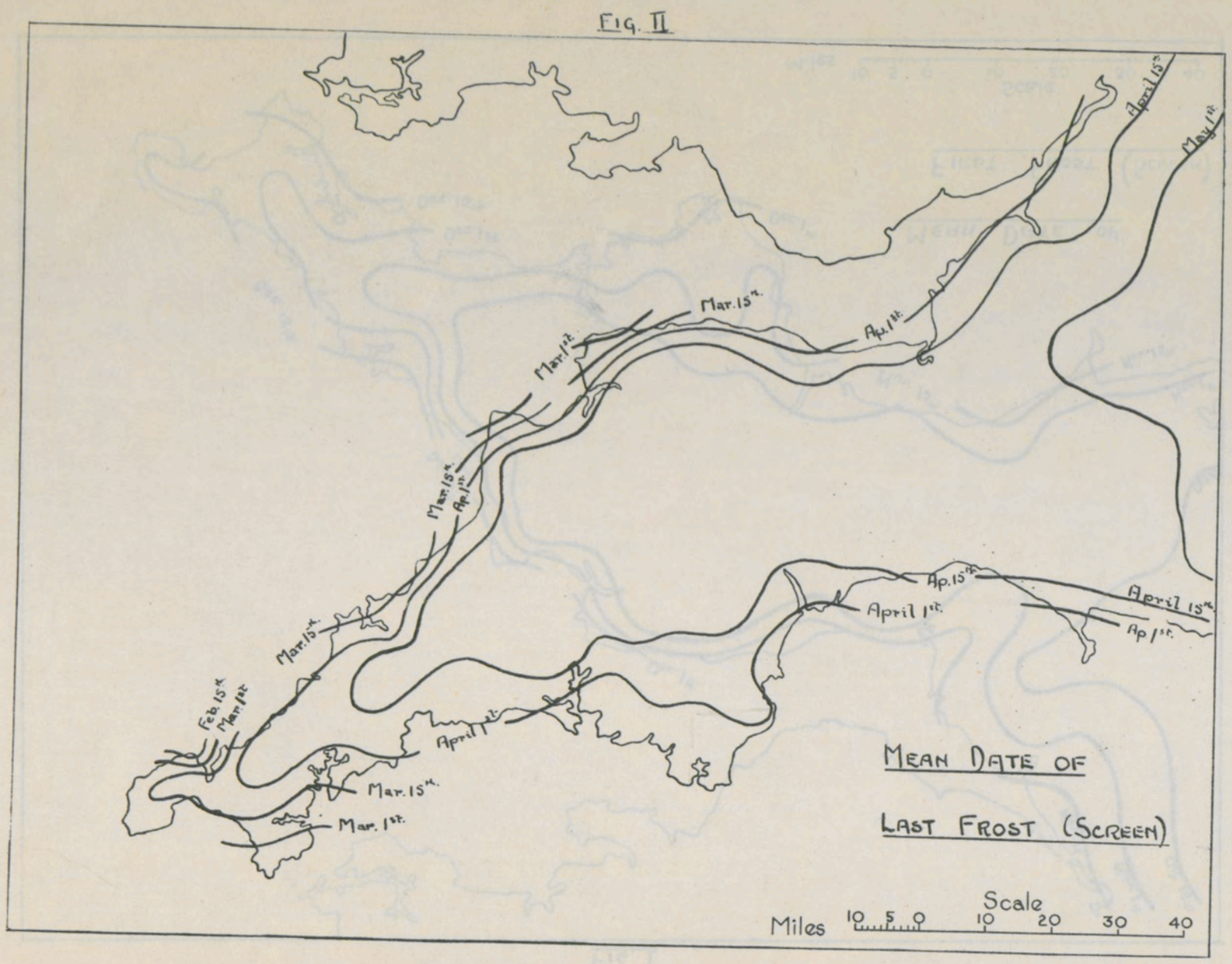


FIG. III

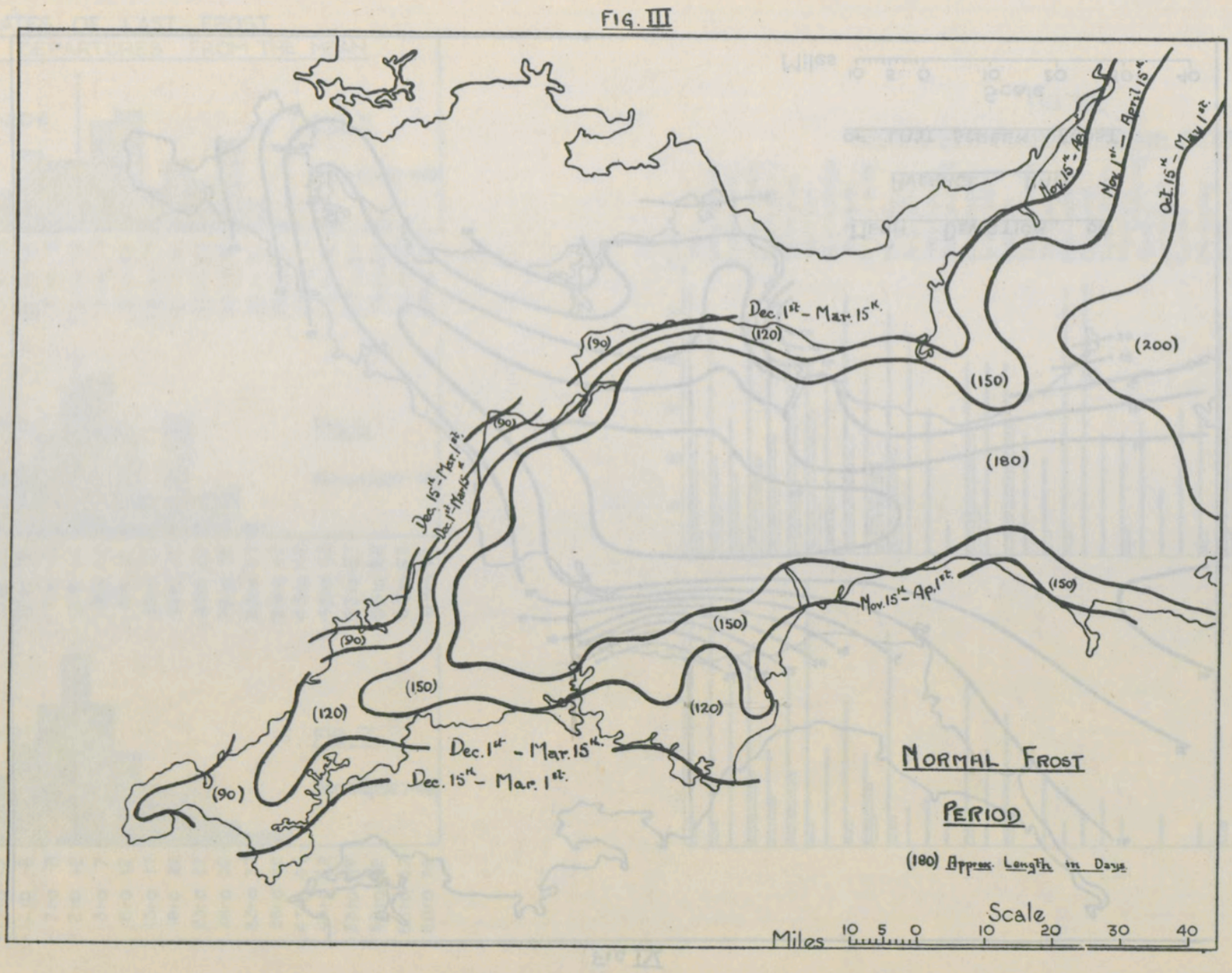
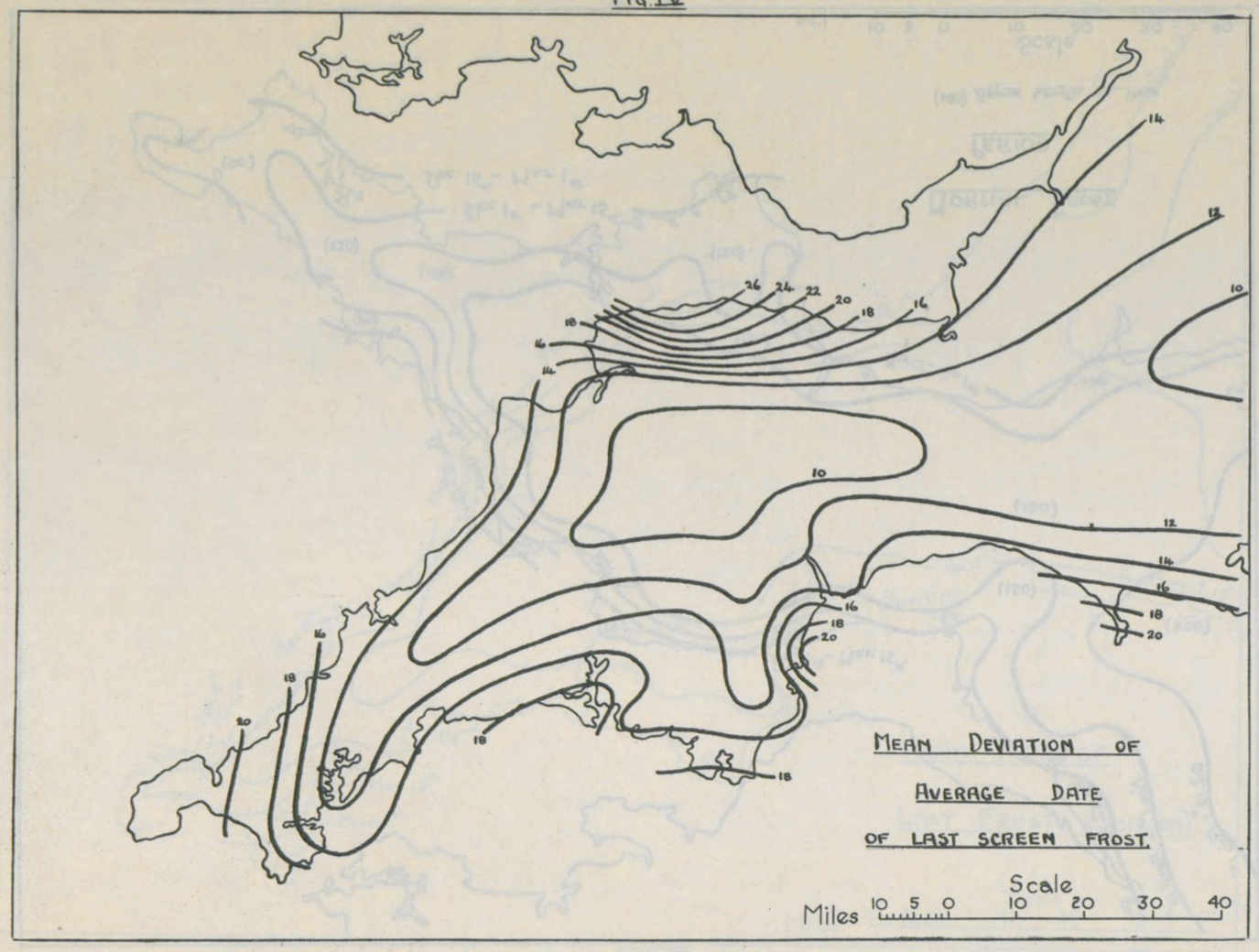


FIG. IV



AVERAGE DATES OF LAST FROST
FREQUENCY OF DEPARTURES FROM THE MEAN

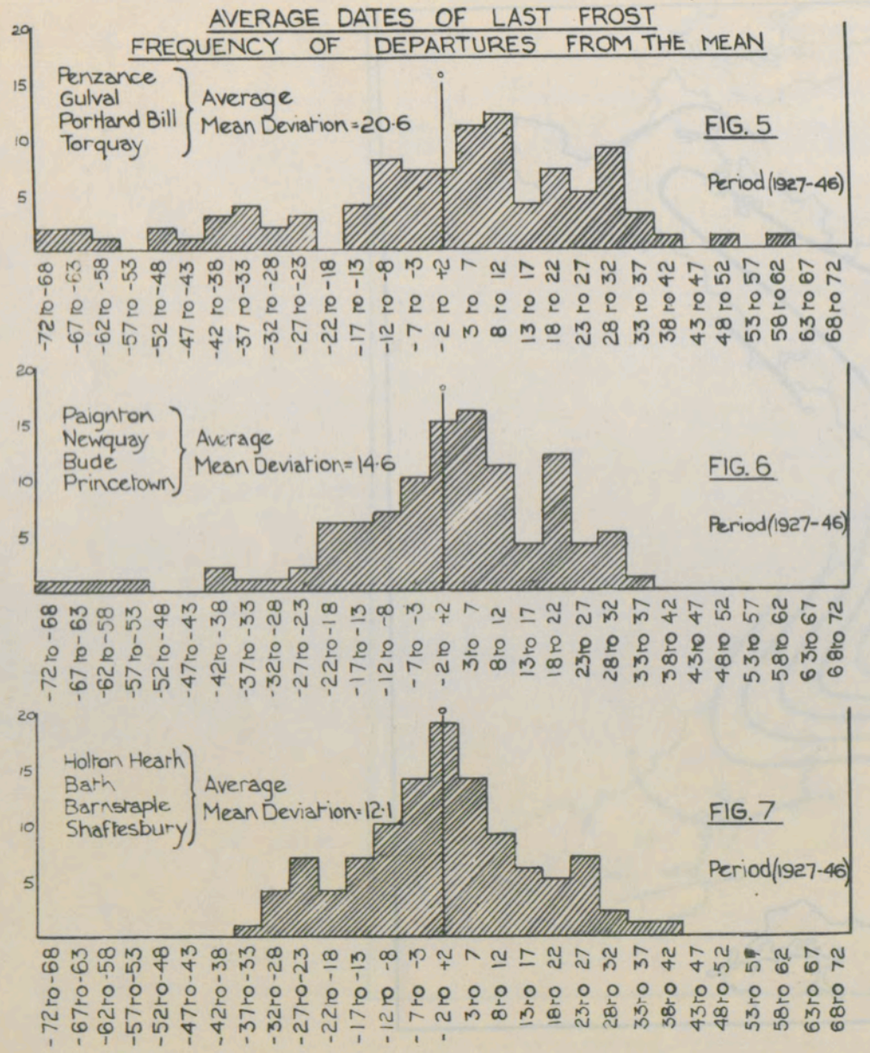


FIG. 5
Period (1927-46)

FIG. 6
Period (1927-46)

FIG. 7
Period (1927-46)

FIG. VIII

PERCENTAGE FREQUENCY OF SCREEN FROSTS

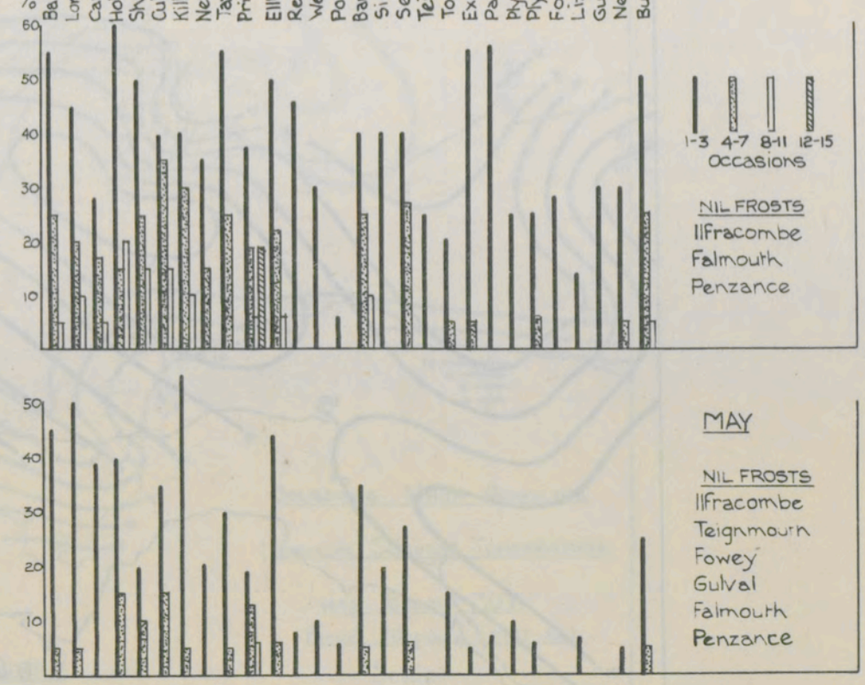


FIG. IX

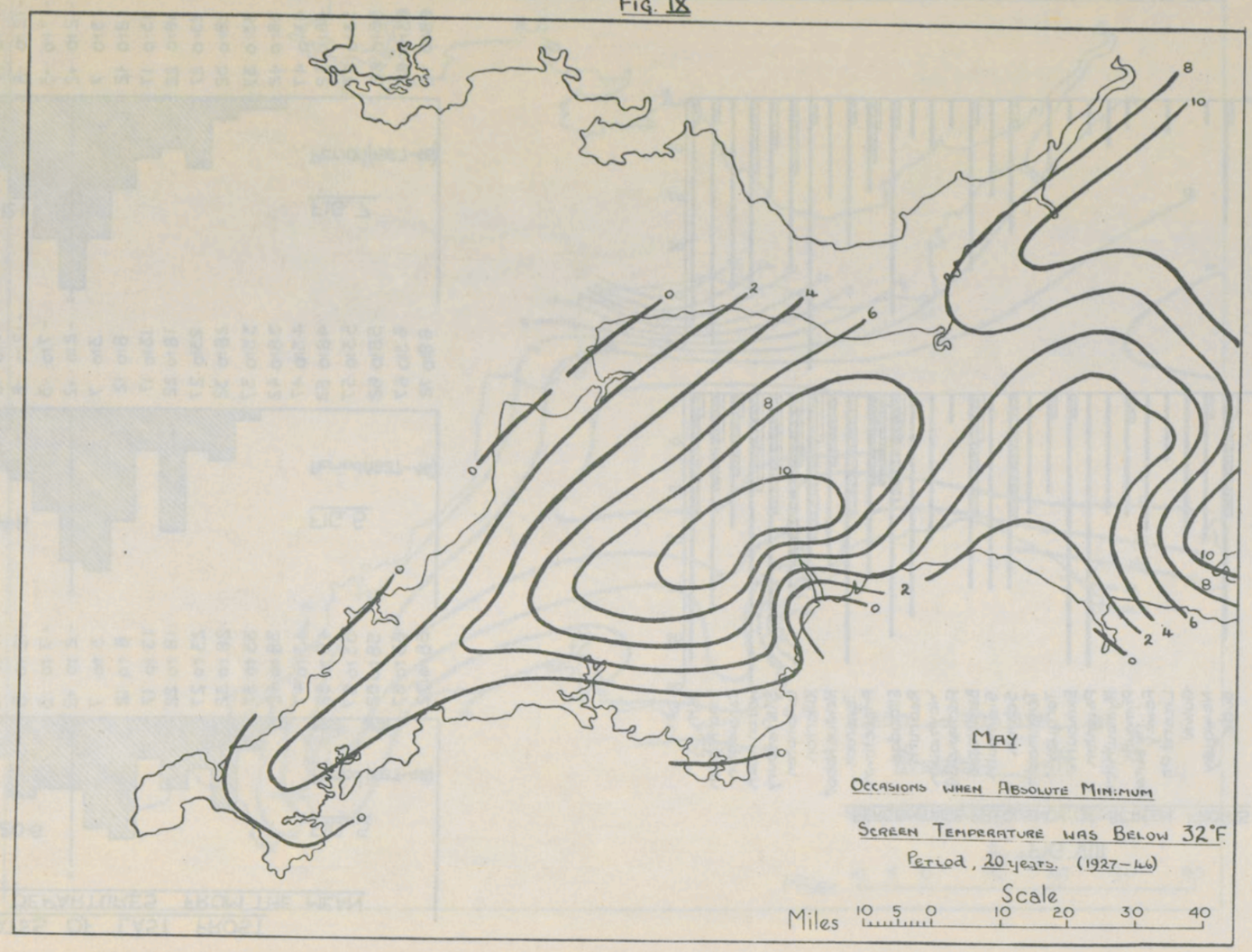

2
4
6
8
10
0
MAY.
OCCASIONS WHEN ABSOLUTE MINIMUM
SCREEN TEMPERATURE WAS BELOW 32°F.
PERIOD, 20 YEARS. (1927–46)
Scale
Miles 10 5 0 10 20 30 40

FIG. X

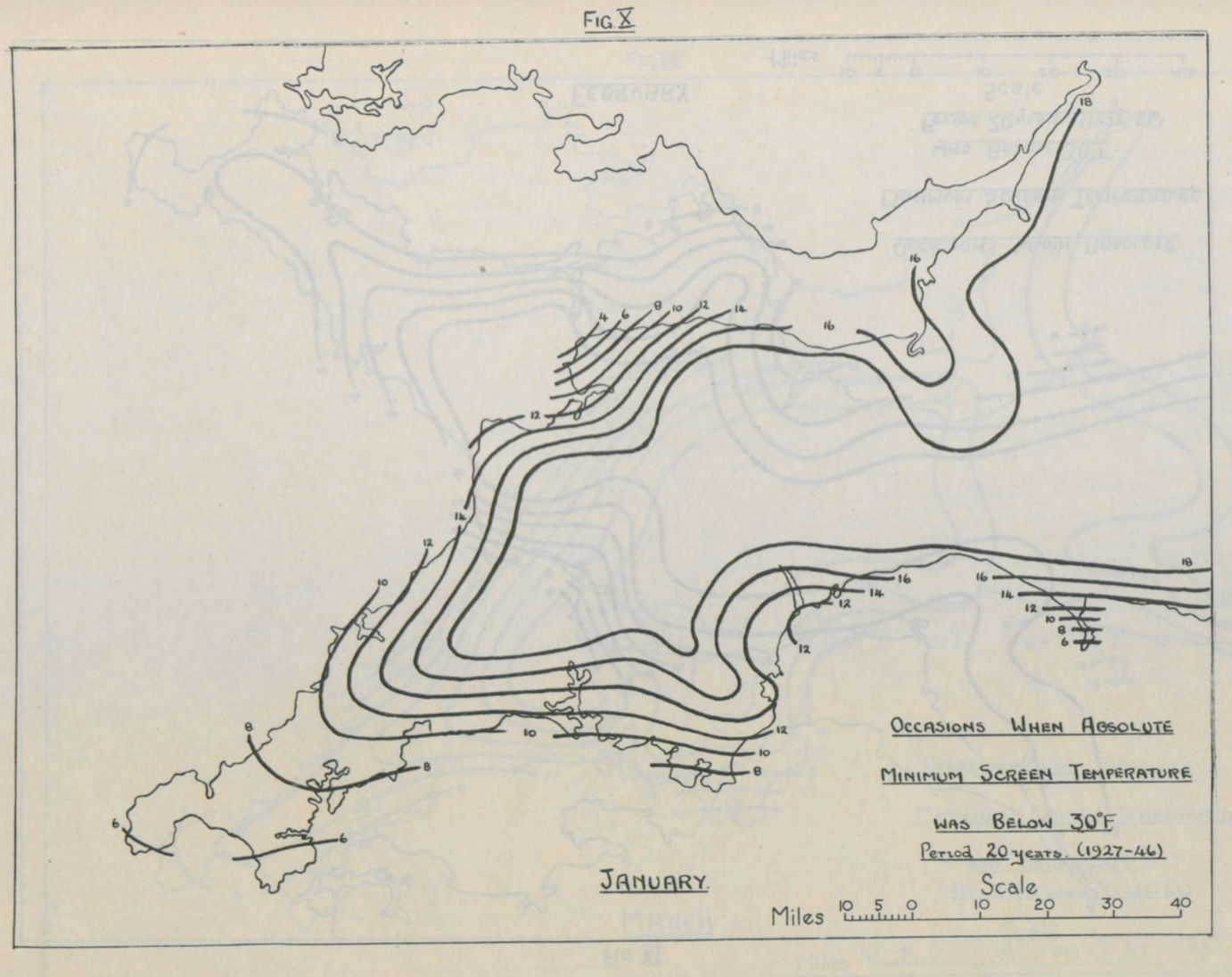

6
8
10
12
14
16
18
JANUARY.
OCCASIONS WHEN ABSOLUTE
MINIMUM SCREEN TEMPERATURE
WAS BELOW 30°F
Period 20 years. (1927-46)
Scale
Miles 10 5 0 10 20 30 40

FIG. XI

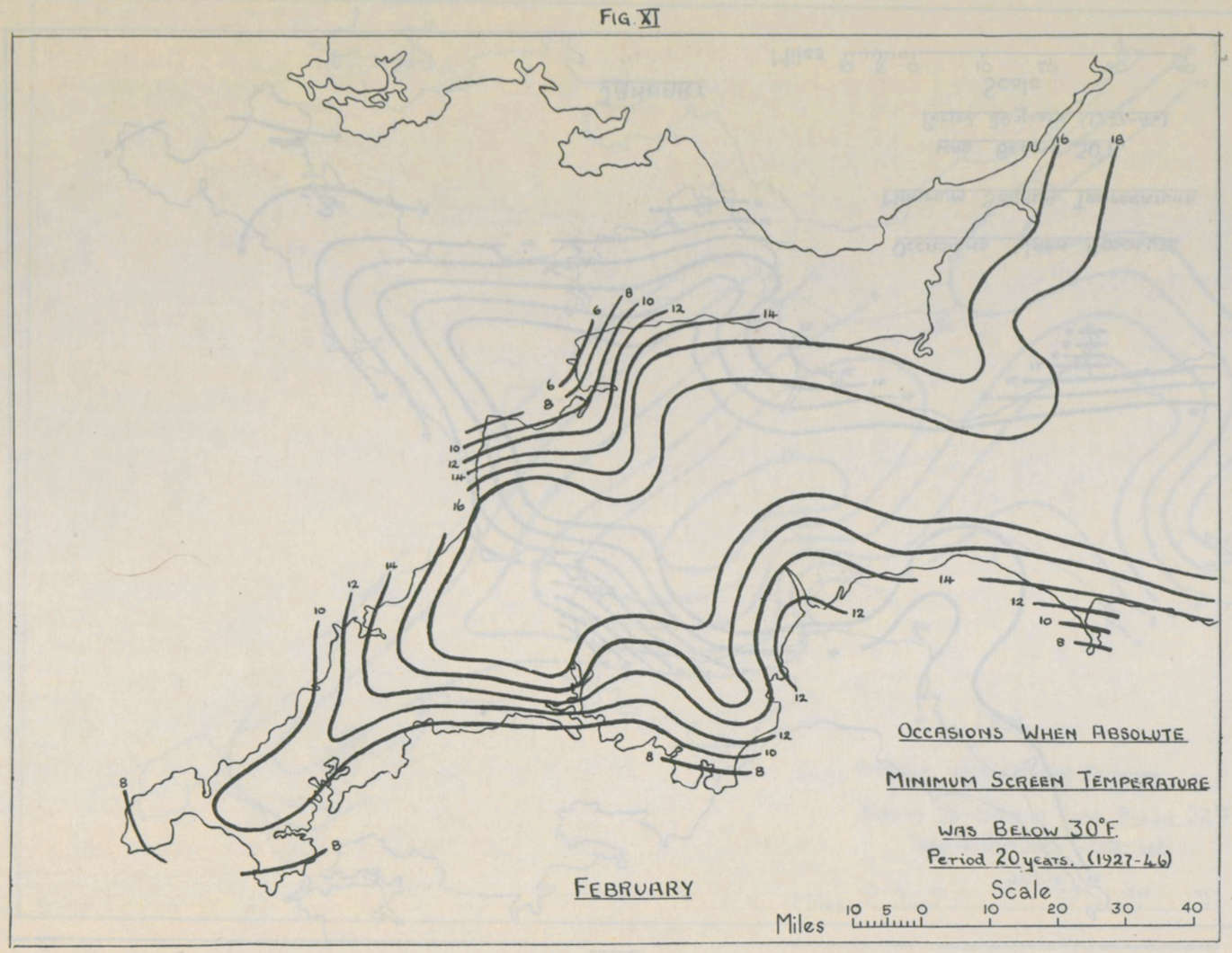


FIG. XII

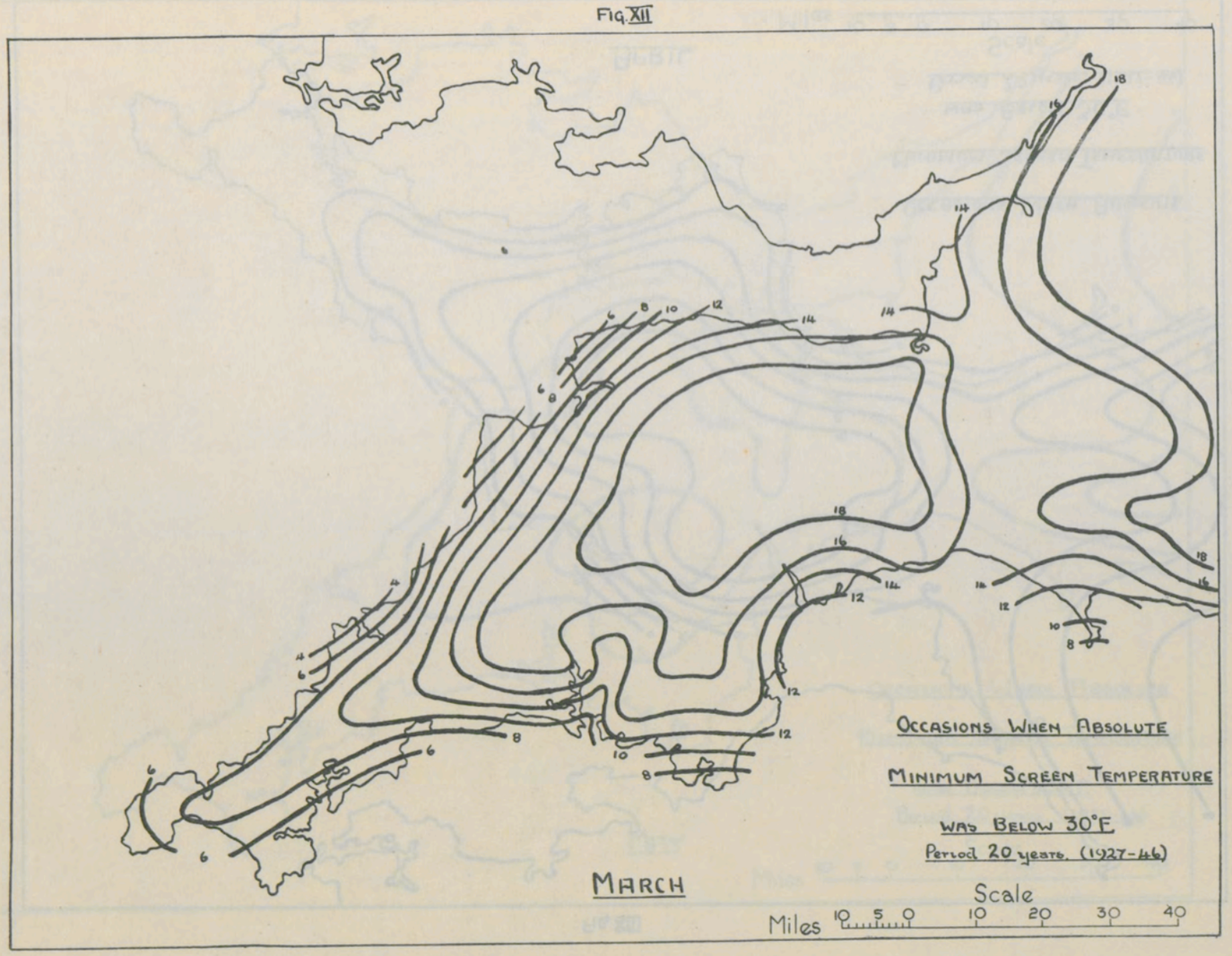


Fig. XIII

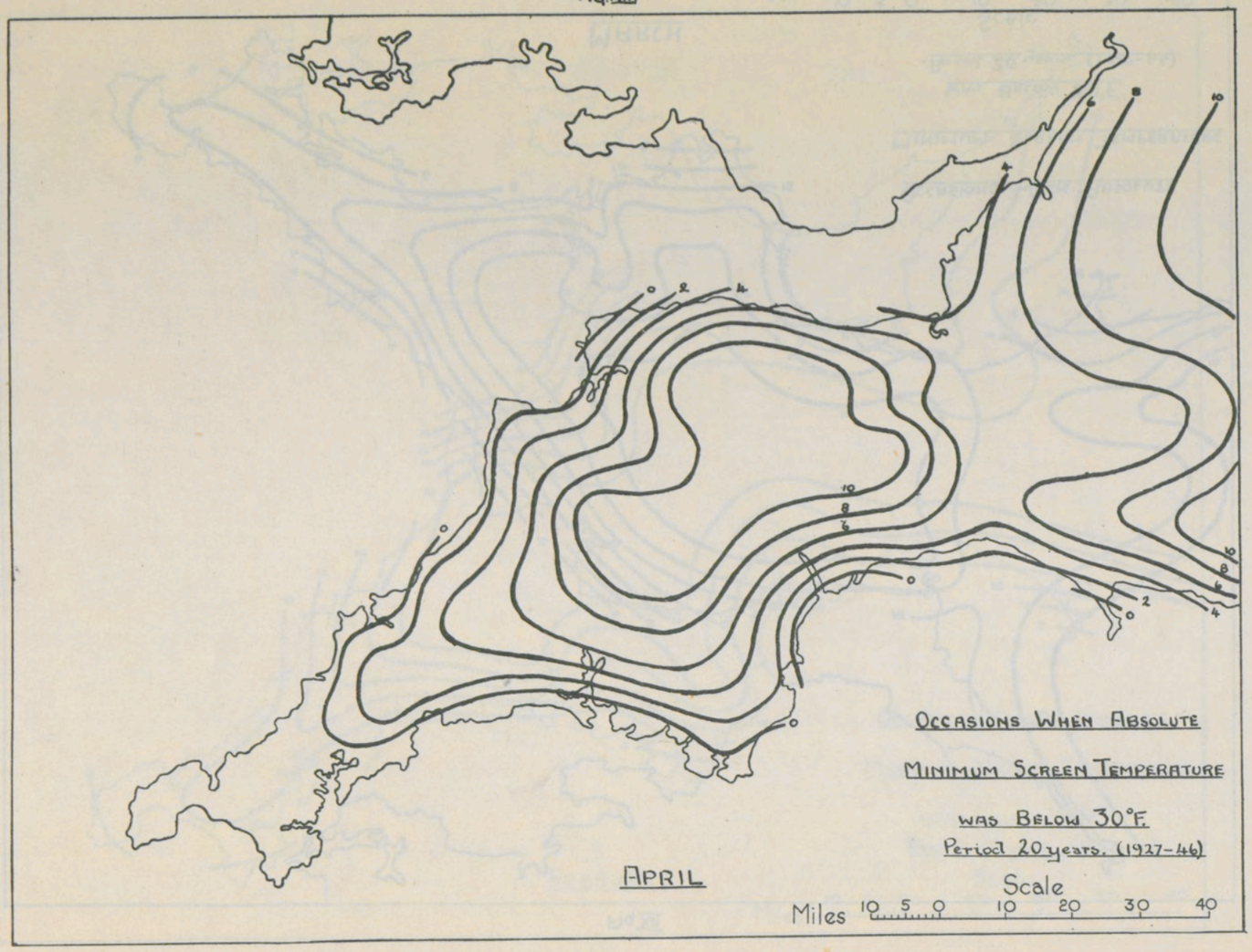


Fig. XIV

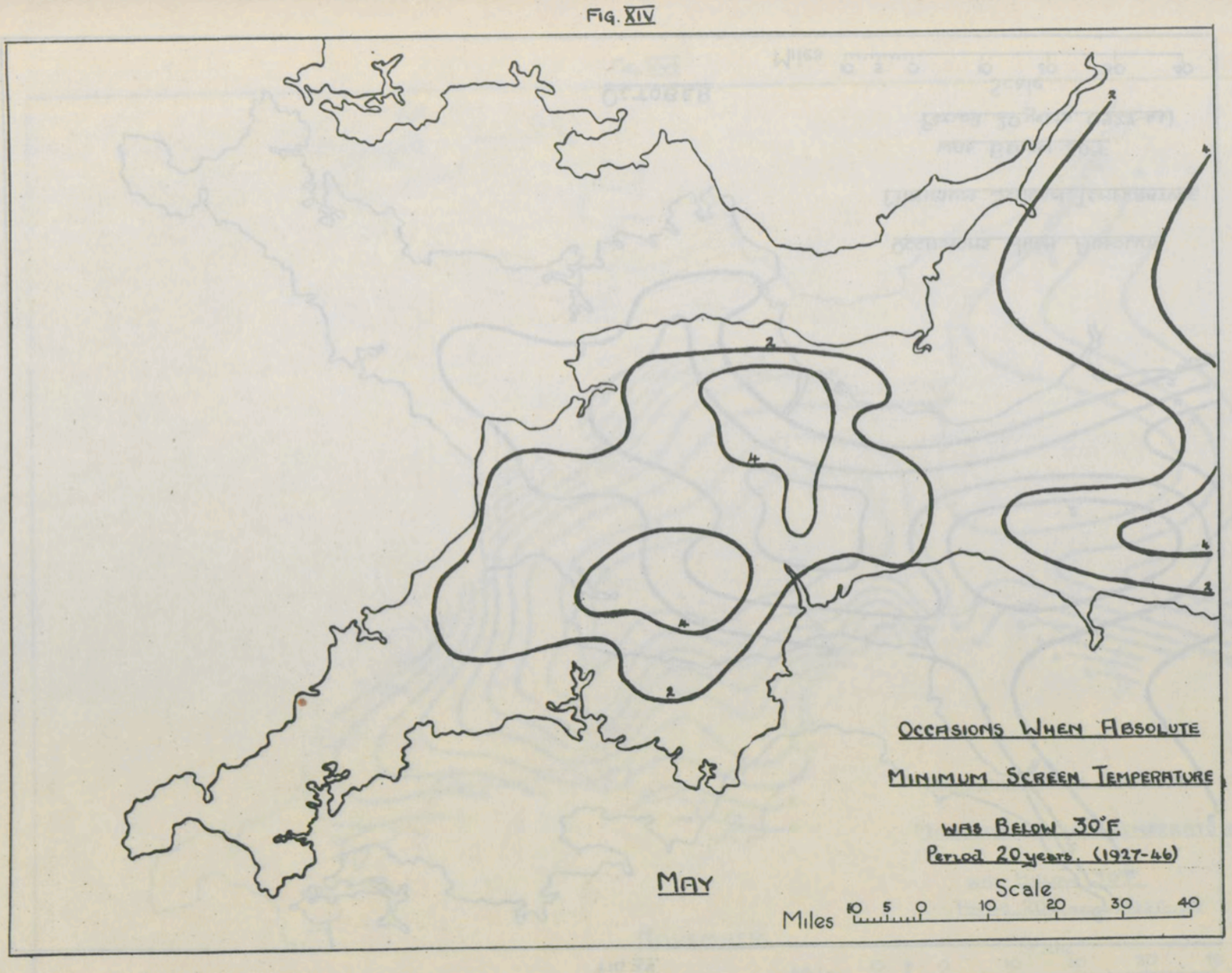


FIG. XV.

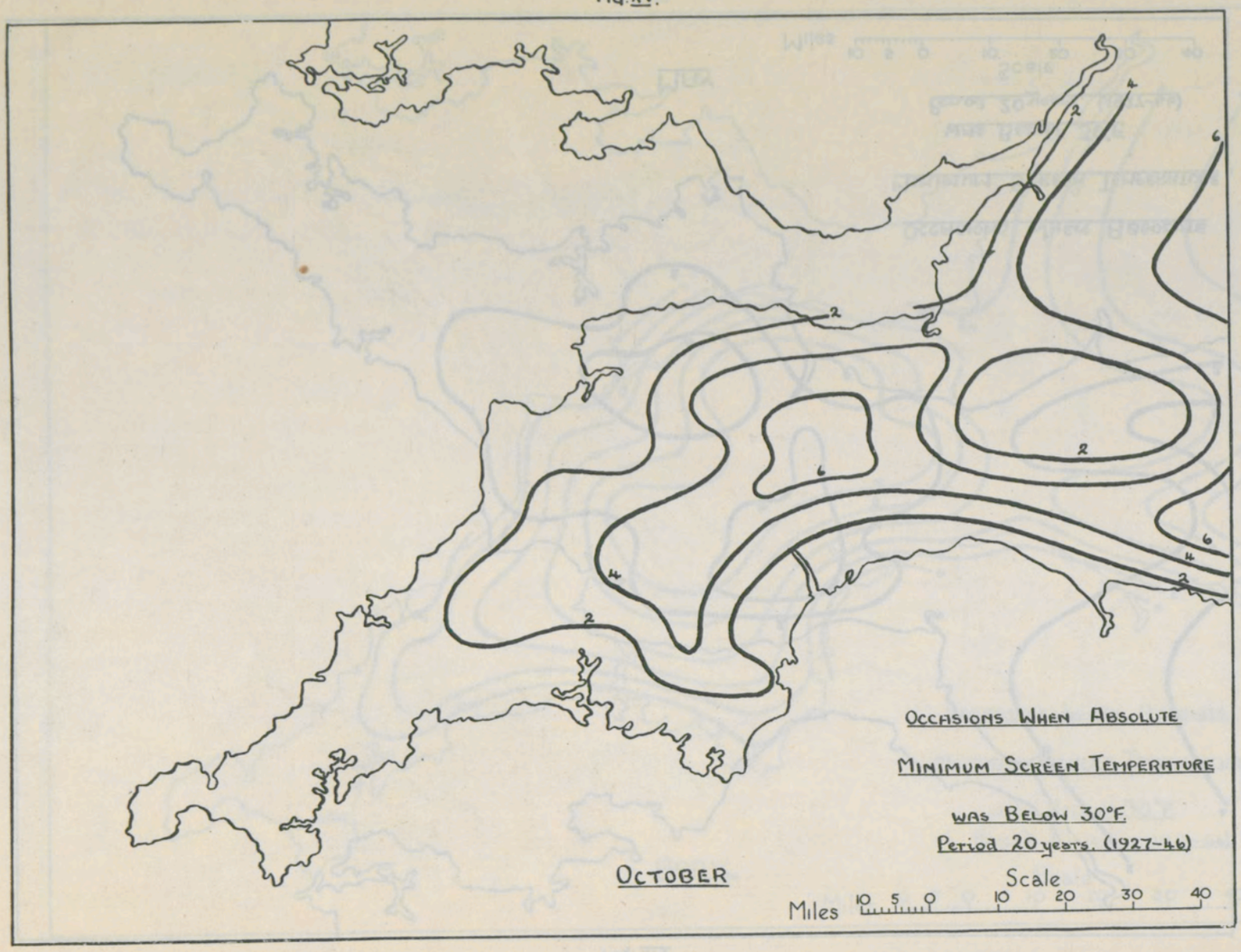
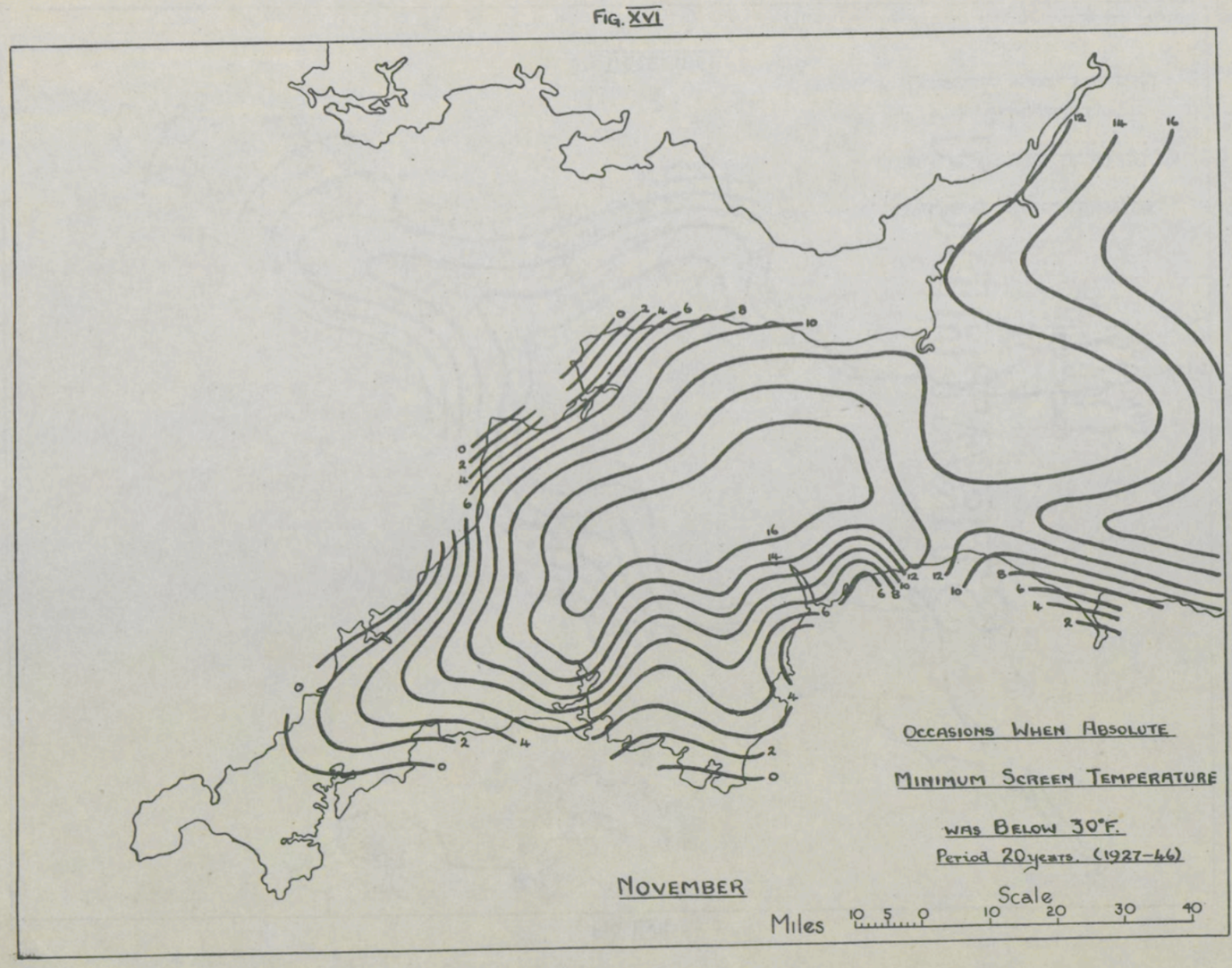


FIG. XVI



DS 516/41/7.46 75 2/48 CL

FIG. XVII